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The Advent of the Fireproofed Dwelling

The most gratifying and prominent development in American building and architecture of the last few years has unquestionably been the increasing interest in fireproof construction and the increasing use of the best fireproof materials. For the first time in the history of the country some popular interest has been aroused in the substantial and incombustible construction of buildings. A certain number of people are beginning to prefer a well-made and non-inflammable house to one which is ill made and at the mercy of every occasional fire; and they are ready to pay the increased money which the more substantial and permanent house costs. They are coming to have a conscience about the substance of their dwellings; and if this more conscientious state of mind persists, it will have most beneficial results upon American architecture and upon the American building material trade. It will give the good architect, the good structural engineer, and the purveyor of good building materials an opportunity such as they have never had in the past, and one which will be far more remunerative both in money and in reputation.

A change in economic conditions has, of course, been instrumental in bringing about this increasing interest in fireproof construction. Americans have become habituated to inferior methods of construction and inferior materials, because such methods of construction and materials were for the time being profitable. Lumber was cheap and was easily obtained. The difference in cost between a frame building and one of substantial masonry was so considerable that very few people could afford the better class of construction. Even those who could afford it were not without good reasons for preferring a wooden house. The time had not come for investing large sums of money in permanent buildings. The country was new. Its social and economic conditions were fluid. The ordinary business man did not want to tie up his capital in structures whose permanence seemed to promise more advantage to his descendants than to himself. It was really cheaper to erect cheap temporary buildings, which would serve his immediate purposes and which could be replaced whenever such replacement became economically desirable. Americans were forced by the pressure of constantly changing conditions to make their arrangements very much for the present and very little for the future. They never knew what a few years might bring by way of a change in economic and social conditions, and they had no assurance that their children would care to carry on their business or to live in their houses. The future, consequently, must be left to take care of itself. A temporary house would outlast its builder—unless it was burnt down; and in that case there were always the insurance companies. Of course, the insurance bills and the fire losses were enormous in the aggregate; but it was cheaper to pay them rather than to spend money upon permanent structures, which, in the course of a few years, would be likely to lose their economic value and their æsthetic interest.

The general attitude of mind towards building sketched above was, of course, the inevitable result of the economic conditions of a new and rapid growing

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community. In the beginning its influence was just as dominant in the case of all classes of building undertaken for business purposes as it was for private residences. The earlier American railroad, factory and office building was of the most inferior construction, and such was necessarily the case, because the inferior instrument was in the experimental and fluctuating condition of American industry, the economical instrument. But American industry soon passed beyond the stage of cheap and inferior construction. The railroads soon found it necessary to build for the future as well as for the present—to put up permanent bridges, larger and handsomer stations, and more substantial roadbeds. Manufacturers discovered that as they enlarged their output they must necessarily improve their factories and erect less inflammable buildings. In the more populous cities, skyscrapers began to be constructed both as offices and warehouses; and it was sheer folly for a man to invest hundreds of thousands of dollars in an inflammable skyscraper. In all these, and in many similar directions, economic conditions have forced the business man to build or rebuild in the most substantial manner. An immense amount of work still remains to be done in replacing the inferior business structures of the last generation, but there need be no apprehension about the result. The substantial fireproof building is becoming for the American business man the economical form of construction; and in obedience to this economic necessity, American engineers have devised many important improvements in the methods and materials entering into fireproof construction.

The methods of constructing domestic buildings have, however, improved very much more slowly than the methods of constructing business buildings of all kinds. The fireproof residence still remains a very rare architectural product. A certain number of them have been erected in New York and other large cities, chiefly because their owners possessed a great deal of rare furniture, tapestries, pictures and the like, which had to be protected from fire consumption. In some few cases. also fireproof country houses have been erected for rich men. But such cases are much less numerous than one would have supposed. The number of opulent Americans who can abundantly afford a substantial and permanent residence, but who, none the less, have been content with a frame, a brick veneer, or some other inferior kind of house is extraordinarily large. Their preference for inferior methods of construction was due partly to bad habits and partly to the fact that until recently an inflammable building was really very much cheaper than a thoroughly fireproofed building. At bottom, however, the trouble was that Americans really did not care. They had no conscience about the character of the house in which they lived. They did not attach any value to the possession and occupation of a permanent and substantial building which was sufficient to make them willingly pay for its increased cost. The consequence is that the great majority even of the very handsome dwellings erected during the past fifteen years have not only not been thoroughly fireproofed, but have not even been of slow-burning construction; and, of course, practically all the cheaper urban structures and country houses have been fire-traps of one kind or another.

During the last few years, however, a change has been undoubtedly taking place for the better, and this change has been due, primarily, to the fact that, while methods of fireproofed construction have been becoming cheaper and better, the ordinary wooden-framed structure has been becoming more expensive. The economic gap between the cost of a permanent and an impermanent building has been closing up. Lumber of all kinds has grown constantly more costly, and its higher price has been due not to temporary, but to permanent conditions. The country has consumed the better part of its vast stock of standing timber and must be content hereafter with a smaller supply. The era of cheap lumber is over. It may well be that the United States will always have cheaper lumber than the countries of western

Europe; but it will never again be so very cheap as to place a high premium on inferior methods of construction. At the same time, for reasons which will presently appear, it has become possible to erect fireproofed buildings for a smaller cost than formerly. Of course, a wooden house still remains the type of building, whose initial expense is least burdensome; but in certain cases a man could figure that a fireproofed building might be actually cheaper in the end. He could figure that in the course of a decade he would save enough in the cost of insurance, in the cost of repairs, and in the absence of deterioration more than to compensate him for the larger initial expense. The consequence was that of late years a number of small fireproofed dwellings have been erected, costing from five to fifteen thousand dollars; and this number is constantly increasing. In another part of this number the reader will find a full account of these dwellings, together with details both of their method of construction and of their actual cost.

The diminished expense of certain excellent and comparatively novel fireproofing materials and methods of fireproof construction has been due to an interesting and significant cause. The enormous demand during periods of business prosperity and expansion has resulted in the building of vast plants for the manufacture of the different kinds of fireproofing materials—in particular such materials as hollow tile and cement. These plants are employed to the limit of their productivity as long as business is active; but during a period of inactivity their owners are in very much the same situation as the owners of a steel-rail plant. They find it very hard, under such circumstances, to keep their machinery working; and they have naturally been seeking some source of consumption which might prove to be more permanent. The only possible source of a more continuous demand is that which might be developed among the builders of residences. Of course, the number of dwellings erected in a prosperous period is larger than the number erected during a period of business depression; but the population of the country increases steadily, and the variations in the demand for the materials entering into residence construction are slighter than those entering into the construction of large business buildings. The tile and cement manufacturers have, consequently, been willing to make sacrifices and to spend money in order to increase the use of fireproofing materials in domestic building; and their efforts have been attended with a certain measure of success. All over the country hollow-tile and cement houses are being erected in larger numbers than ever before, and the movement has only begun. There can be no doubt that the small, as well as the large, fireproofed dwelling is destined to become a common type of building.

It should be remarked, however, that the employment of these materials is still only in an experimental stage. Builders, architects and mechanics will have to learn slowly how they can be used most safelv and most economically.

Up to the present time, reinforced concrete has been more widely advertised as the coming fireproofed method of construction; and in certain essential respects the cement building promises to be the most perfect fireproof structure. But there are many problems about reinforced concrete construction which may have been solved, but whose solution is at present beyond the power of the average architect and builder. This type of construction remains one which for the present demands the presence on the job of a skilled engineer; and in many instances the price of a small house cannot bear the expense of such expert assistance. It is this fact which has contributed to the recent popularity of hollow-tiled houses. Hollow tile was, of course, manufactured originally for the purpose of affording a protection for the steel framework of a modern skyscraper, and only recently has any attempt been made to use it in the construction of an ordinary wall. It has the advantage, for such a purpose, of being easily and economically laid and of affording a rough surface, to which plaster will adhere without the assist-

ance of any lathing. On the other hand, it is not like cement, a material which can be used for all kinds of purposes. The larger the house, and the more elaborate its architecture, the more cement beams and piers have to be inserted as a supplement to the hollow-tiled wall; and even in small houses hollow-tile construction involves the help of a good deal of cement. It remains true, none the less, that the use of tile for the walls and to a smaller extent for the floors of dwellings, has been an immense advantage to the cause of fireproof construction. It has made possible the partial, or complete, fireproofing of many residences which for one reason or another could not have been built of concrete. It involves a simple but sound method of construction, which can easily be mastered by the ordinary builder; and while it demands a higher and more careful standard of workmanship than a frame house, it does not call for the same sort of expert knowledge as does thoroughly good cement construction. It has undoubtedly come to stay as one method of fireproofing the ordinary building; and in the course of time the method of construction it involves will become still further diversified, simplified and cheapened.

As to the several kinds of reinforced-concrete construction, they probably have a greater future than has any other method of building fireproofed residences. It may be doubted whether Mr. Thomas A. Edison has as yet really perfected a practical method of building little concrete residential boxes, which can be duplicated *ad infinitum* at a small cost for the American workingman; but it is very probable that eventually some plan similar to that of Mr. Edison's will be realized. A few generations from now the majority of American urban and suburban residents may well be living in concrete houses of one kind or another—without any fear of fire or of vermin, and without paying for these substantial living accommodations any more than they are now paying for their more or less flimsy dwellings. Concrete buildings have the peculiar advantage, for general popular use, of being capable of standardization. An indefinite number of concrete houses can be manufactured from the same mould, and such methods of manufacture are always attended with great economy. At the same time, it has the promise of being a very flexible material and method of construction—flexible, that is, in the sense of being adapted to use in a great variety of moulds. Its chief defect is the result, perhaps, of the highest quality. It is, if anything, too permanent. The owner of a concrete house cannot knock out partitions and put in new doors and windows wherever and whenever he pleases. He is possessed of a very substantial structure; and it behooves him to take every care that his house is as near right as possible when it is built.

The foregoing consideration suggests the great advantage which will result to American architecture and building from the advent of the fireproofed dwelling. The fact that people are building permanent houses will increase the sense of responsibility all along the line. The owner will feel more responsible, because he will be making a larger initial investment in his dwelling, and he will, consequently, be more careful to employ a good architect and to insist on good workmanship. The architect will feel the effect of this solicitude on the part of his client. He will try harder to turn out a thoroughly satisfactory plan and design; and if he does not succeed in doing so he will have small chance of considerable employment. His mistakes will find him out much sooner than do those which he commits in some easily alterable frame house. Similar influences will be brought to bear upon the builder and the building material dealer. The dealer will have to furnish thoroughly good materials, because the method of construction demands them; and inferior materials will, consequently, suffer from a far more effective discrimination than that which now obtains. In the same way, untrustworthy builders will be treated with small consideration. Inferior workmanship is much more likely to be discovered than it is in the case of a frame house; and when it is discovered the consequences will be so

serious that the offender will be blacklisted. This discrimination against bad workmanship of all kinds will, of course, be tantamount to a discrimination in favor of good workmanship—which is practically the kind of discrimination of which American building and architecture is most in need. The general employment of inferior building materials and inferior methods of construction has been the great fundamental cause of the demoralization of American building practice. Inferior materials and methods have encouraged irresponsibility. Take, for instance, the situation of a man who proposes to erect for his own occupancy a comparatively expensive frame dwelling. If he were spending $40,000 or $50,000 in any other way his dominant preoccupation would be to see that he received good value for his money; and, of course, even in the case of a frame dwelling, he wants good value in the sense that the house must conform to the best recognized methods of frame construction. But the point is that the best value which an owner can get in respect to a frame house, even with brick or plaster veneer, is a poor value. He has no reason to take any particular interest in the construction of such a building; and inasmuch as he naturally feels a great deal of interest in a project upon which he is spending $50,000, his interest is concentrated upon the plan and the design. It is perfectly right and proper that he should be interested in the plan and design of his house, but in the case of a frame house his exclusive interest in these matters is usually embarrassing to his architect. It usually takes the form of attaching great importance to some details of the plan or some one or two features of the design; and his tendency is to insist upon the subordination of the unity of the plan or the design or both to the details upon which he has happened to fasten his interest. In fighting this tendency, the architect cannot derive any assistance from the method whereby the building is constructed. A frame building is one in which the structure imposes very few conditions on the architect or owner. It does not prevent, by the necessity of its existence, either the owner or the other from indulging in any arbitrary whim or fancy. Both the design and the plan occupy only a very casual relation to the structure, and in opposing any whimsical mutilation of his plan or design the architect has only the weapons of his own personal authority with his client. In case, however, the house he is building is fireproofed, the owner is much less likely to interfere. In that case, according to the testimony of many architects, he usually becomes interested in the construction of his house and in the excellence of the workmanship; and whenever he does have any inclination to merely whimsical interference with the design or the plan, the architect can usually find some good reason connected with the structure of the building for his own arrangements.

More important, however, than the increased sense of responsibility imposed by fireproofed construction on the client will be the increased responsibility imposed upon the architect himself. Our domestic architecture was wont to be lacking in serious purpose as long as inferior methods of construction continued to prevail. The frame building has been in the past the most potent possible cause of architectural frivolity. The American house builder and house designer have never taken the wooden structure seriously—as it has been taken seriously by the Japanese and the Swiss. Their tastes have run in the direction of duplicating on American soil the various classic domestic styles of Italy, France and England; and they have satisfied this taste regardless of the fact that they were erecting frame rather than masonry structures. They have been sedulously trying to make wooden or frame buildings look like something else; and this attempt has been at the root of the great majority of the abuses and deficiencies of American architectural practice. It has encouraged the habit of treating architectural houses chiefly as a matter of scenery, of designing both the interior and exterior of a building exclusively from the point of view of how it looked, and without regard to struc-

tural conditions and truths. The architect considered himself emancipated from any necessity of treating either the structure or the material of a house sincerely and candidly; and his freedom in this respect was a fatal bar to the development of a really serious and sound architectural tradition.

The habit of American architects of designing residences with small respect for structural and material truths has had its good aspect. It has unquestionably tended to establish a certain tradition of good form in American domestic architecture, which may in the future be productive of wholly admirable results. The better European styles have been thoroughly domesticated and popularized in this country; and a foundation has been laid of popular interest among well-to-do people in good-looking buildings, which, perhaps, could not have been established in any other way. But in the hands of inferior designers the practice has been very demoralizing, and even at the best it has had its inevitable tendency to frivolity and insincerity. It has resulted in an excessive use of ornament and of useless ornamental architectural members. It has enabled the designer to complicate and elaborate the appearance of his building, wholly irrespective of the facts of its construction; and it has, consequently, stood in the way of any thoroughgoing simplicity and integrity of architectural design. The advent of sound methods of fireproof construction will necessarily discourage the merely scenic architect. He will be confronted, as the fundamental condition of his design, by a permanent structure which cannot be wholly ignored. This structure will be relatively costly, and will absorb a larger proportion of the total appropriation. The architect will have less money to spend upon ornament; and the increased expense of working substantial materials will also prevent him from decorative overelaboration. He will be obliged to simplify and to devise some more substantial means of obtaining interesting effects. He will be stimulated, that is, to design buildings whose appearance will be the outcome of certain fundamental structural facts, while at the same time his success as an architect will depend upon his ability to make these structural facts pleasing to the eye. The American houseowner has become, as we have said, accustomed to a certain tradition of good form and the introduction of fireproof construction will not in this respect change his habits. It will be the duty of the architect to make these comparatively more unornamented fireproofed houses attractive to their clients; and in so far as they succeed, American domestic architecture will take a long step in advance.

It is devoutly to be hoped, consequently that the newer and cheaper methods of fireproofed construction will continue to increase in popularity. The substantially and permanently built residence is the one thing which is needed to stimulate American architects and builders to a much higher standard of achievement, and when it comes to prevail it will necessarily discriminate powerfully on behalf of the trustworthy architect, builder and building material manufacturer. It takes good men to do thoroughly good work, and the owner, when he comes to want good work, will see that he gets good men to perform it.

A reputation for excellence of achievement will, consequently, be much more valuable to the manufacturer, the builder or the architect than it is at present; and such a reputation can be acquired only by actually delivering the goods.

A. C. David.

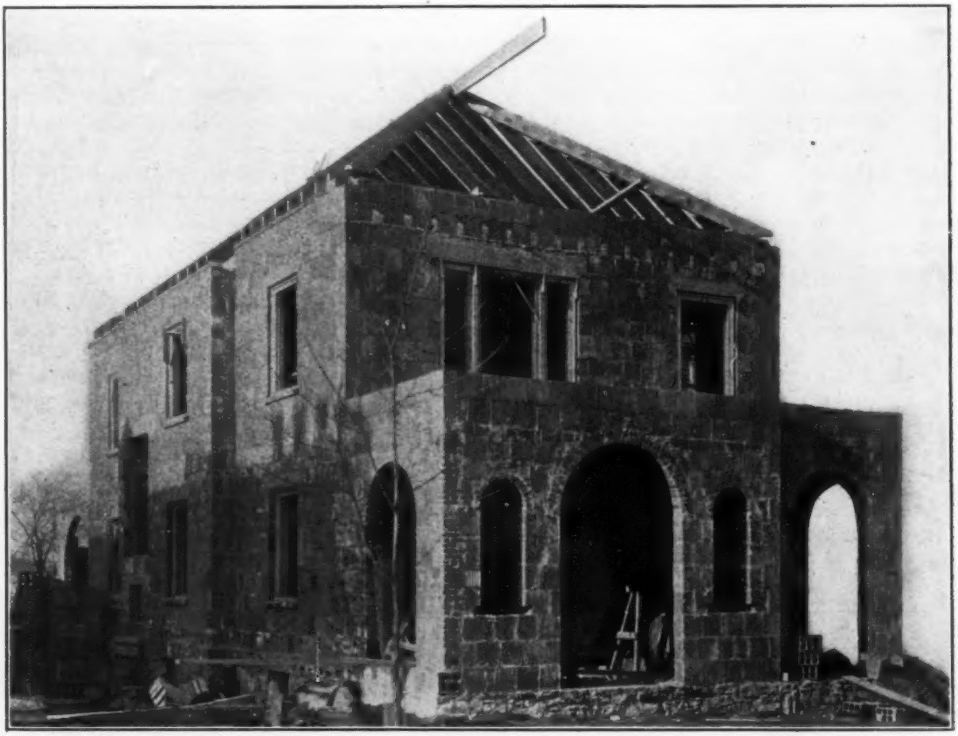
Some Structural Aspects of the Fireproofed Dwelling.

Strictly speaking, the building of the home is not a real estate operation. If we are not willing to admit this, we have no business to speak of the home; we must call the structure merely a house, built to attract the favorable notice of the intending purchaser, without regard for the consideration of special needs and preferences. Of course, there is such a thing as a good average dwelling house, embodying the average taste and requirements of that class of individuals who may reasonably be expected to inhabit a given locality, but the consideration of that problem is for the realty promoter, whose concern it is to draw from an investment as large a return as possible in the shortest period of time. In this case there can be no question of special requirements for special needs. The subject concerns the *house buyer,* and not the *home builder.* What we have to say here is for the interest of the latter, who, in the nature of the case, embarks upon an enterprise from which he expects no return beyond the pleasurable sensation of being the possessor of a real home, and the enjoyment of a certain wholesome intellectual influence which its high standard of adaptability and permanency begets.

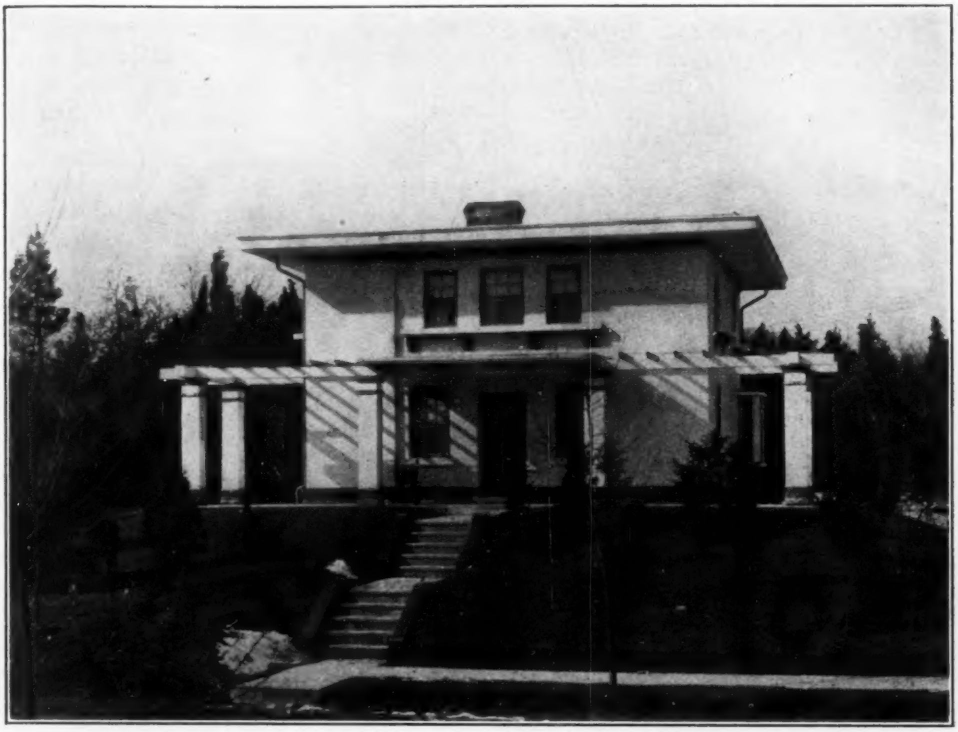
The building of a permanent home has in the past been beset with certain economic obstacles, which, as the leading article in this issue points out, are being slowly removed by the possibility of a wider use of incombustible building materials. It is only now beginning to be possible, financially, for the man of moderate means to build himself a permanent dwelling. The sort of structure which his means have permitted him to essay, up to within a comparatively few years ago, has been one whose effective life could, under favorable conditions, hardly exceed a generation. That was the frame house, which is destined to continue to play a large part in the cheaper country suburban development, on account of its low first cost and profitable nature to the investor. The first question which the intending builder of a fireproof home would ask about the different forms of incombustible construction is undoubtedly how they compare in cost with the prevailing frame construction. Anticipating this query, let us admit in the beginning that, under the most favorable conditions, they are more expensive for the house costing, of good frame construction, from $4,500 to thrice that sum, by from ten to fifteen per cent. in the larger structures, to from twenty to twenty-five per cent. in the smaller ones. For example, the little fireproof house in Caldwell, New Jersey, illustrated herewith, which cost $4,500, complete, as it stands, that is, including the plumbing, heating and lighting, would cost approximately twenty per cent. less, or about $3,600, if built of a fair grade of frame construction. For the accommodations which it provides it would, no doubt, be as easy for an intending speculator to make as much actual profit on the cheaper house. Therefore, from a speculative standpoint, it would be folly for him to invest the larger sum and realize a proportionally smaller return. But for the home builder, this same design, built of wood, would not be the same as built of incombustible materials. In the first place, the wooden house would pay a high rate of insurance, whereas the other would hardly need to be insured at all; the life of the frame house is from twenty-five to thirty years, and depreciates at the rate of from two to three per cent. a year, while the life of the latter is practically indefinite and involves very little or no repair bills, besides carrying among its advantages increased comfort in summer and smaller coal bills in winter. It is a matter of simple computation to figure out in what period of time

the cost of the two constructions would be equal, after which the saving and increased value would be entirely in favor of the fireproof house. As the size of the house increases from the modest dimensions of the Caldwell establishment to the eight or ten thousand dollar home, the saving in maintenance charges becomes greater with a correspondingly smaller increase in first cost, until there is reached a house which would cost, without lavish expenditure on interior embellishments, upwards of twenty thousand dollars, when there would be comparatively little difference in first cost between fireproof and non-fireproof construction.

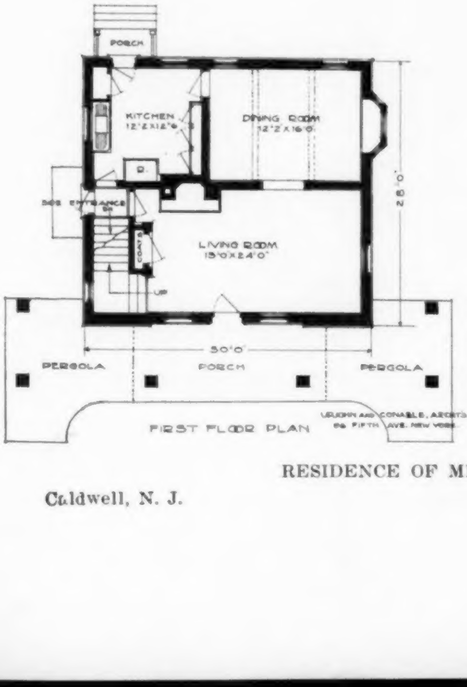
These cost factors, it should be explained, apply only for a fireproof construction not involving an exclusive or very extensive use of cast reinforced concrete. For such a type of fireproof building, it seems now to be generally conceded, the cost is prohibitive, save under most favorable circumstances, and for houses costing to build not less than from fifteen to eighteen thousand dollars. The reasons for equalization in first costs between fireproof and non-fireproof constructions in the larger houses are not difficult to find. In the first place, as the dimensions of the plan increase, the structural advantages of fireproof materials only begin to come into play, while the materials employed in the small frame house become structurally inadequate and have to be assisted by stronger materials, meaning in-

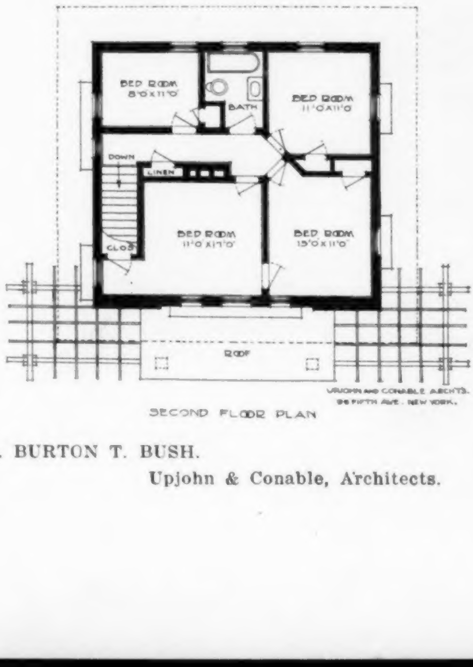


This illustration shows clearly the way in which hollow tile walls are built. The work in this case was done by an Italian mason under competent direction. The use of brick as a filling for forming the arches is noticeable. The concrete lintels may be seen over the second story windows, and the ends of the concrete floor beams, some of which are supported on these lintels. This house is fireproof up to the roof, which, as will be noted, is of the ordinary wood rafter construction.



An all-fireproof suburban house, which cost, including plumbing, heating and lighting, $4,500. The walls are of 8-inch and 10-inch hollow tile, floor and roof of concrete slabs with widely spaced concrete girders. The finished floors of Georgia pine on sleepers constitute, besides the doors and window frames, all the combustible material used. Even the stairs are of concrete, the treads alone being of wood.





RESIDENCE OF MR. BURTON T. BUSH.

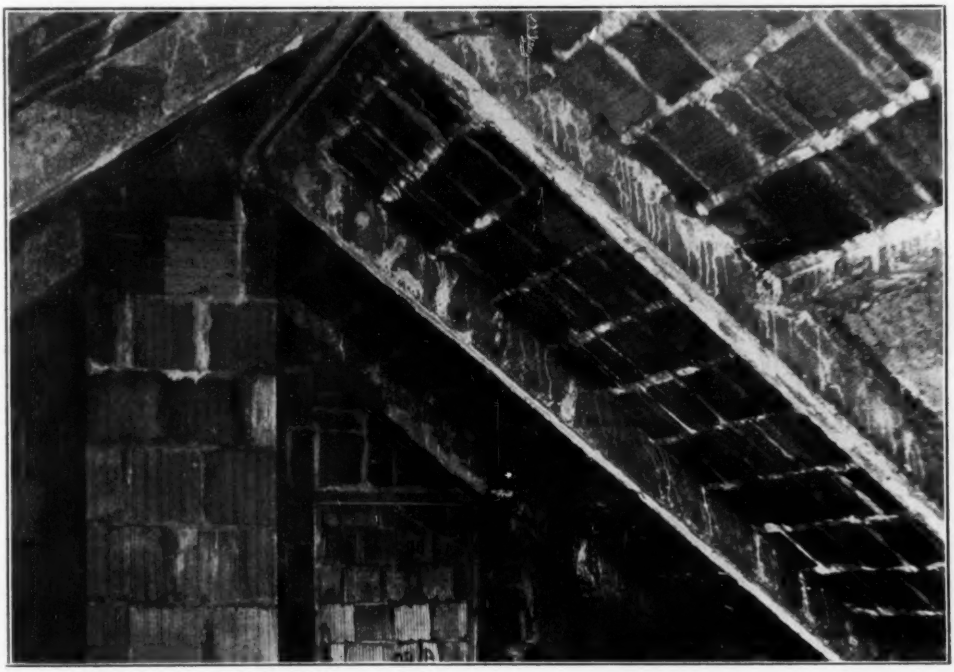
Caldwell, N. J. Upjohn & Conable, Architects.

creased expense. Secondly, it is easier and, consequently, cheaper in the large house of fireproof construction to execute an elaborate scheme of interior decoration than it is in a house of the same size built of non-fireproof construction. Attention should be called to the fact that in the smaller houses in which the structural materials are hollow tile and concrete, or concrete alone, the carrying strength of the floors and walls, built as they are at the present time, is found, by actual experiment, to be considerably in excess of what is required for abundant safety. Popular faith in reinforced concrete construction has, during the past five years, been severely shaken by disasters resulting from an absence of competent structural design and conscientious workmanship. These failures have led even the most competent engineers and architects to design their constructions very conservatively, that is, with large factors of safety, to restore public confidence in the material and to guard against the pitfalls of past disasters.

The economic conditions which are making it possible and desirable to construct our country and suburban houses of unburnable materials are effecting a simplification in building construction which cannot fail to exert the most powerful influence on the popular appreciation of architecture. The simplified methods of putting together the different materials will interest the prospective builder, because they are simple enough to be appreciated by him. There will, consequently, result between him and his architect a bond of understanding which will enable the latter to approach the problems of design with a freer hand. The owner will be more in position to see for himself that, although the construction of his house is highly interesting, it lies outside of his legitimate province with questions of design and decorative treatment. To get him into such a frame of mind is one of the most important steps in raising the standard of American architecture.

It has steadily been impossible to reach this position in the past, chiefly because the designing of a frame house, or one in brick or stone is so full of mechanical complexities and details that it has not been possible to get matters of construction clearly before the layman. Those things which are concealed in these constructions have steadily confused and disturbed him, and this is not to be wondered at when we consider how unreal is the spirit of modern construction in relation to its visible expression. Since he could not be interested in the construction of his house, the lay builder naturally turned his attention to matters of architectural design, which he wrongly assumed were so much simpler and whose acquaintance he imagined was to be so much more readily made. To have his attention directed to construction, and especially fireproof construction, its simple use of hollow tile and reinforced concrete cannot fail to be potent in convincing him of the true function of his architect.

The materials which enter fireproof construction are already fairly familiar to the layman. Hollow tile he has seen used so much in recent years as a floor material in fireproof city buildings and as a fire protection for the structural steel beams and columns, while concrete is equally well known in the same way. He may even have noticed entire buildings cast in concrete over a network of slender horizontal and vertical steel rods. In the suburban and country houses of hollow tile, of which a number are illustrated in these pages, these materials are used in a similar manner, but much more simply. Rows of hollow tile, with alternating beams of concrete, containing at the bottom one or sometimes two very slender steel rods (generally only one ⅜-inch, ½-inch or ⅝-inch rod in each beam is necessary), form the floors, while the hollow tile, laid, as shown in our illustration, in Portland cement, constitute the walls; thinner hollow tile blocks, similarly laid, serve as the interior dividing walls or partitions. Under ordinary conditions the floors and walls are built of the same size tiles, which are divided interiorily by intermediate integuments called webs, from ⅝-inch to 1-inch in thickness. These tiles are burned under a temperature of about 2,500°



RESIDENCE OF MR. FRANCIS C. HUNTINGTON, IN COURSE OF CONSTRUCTION.

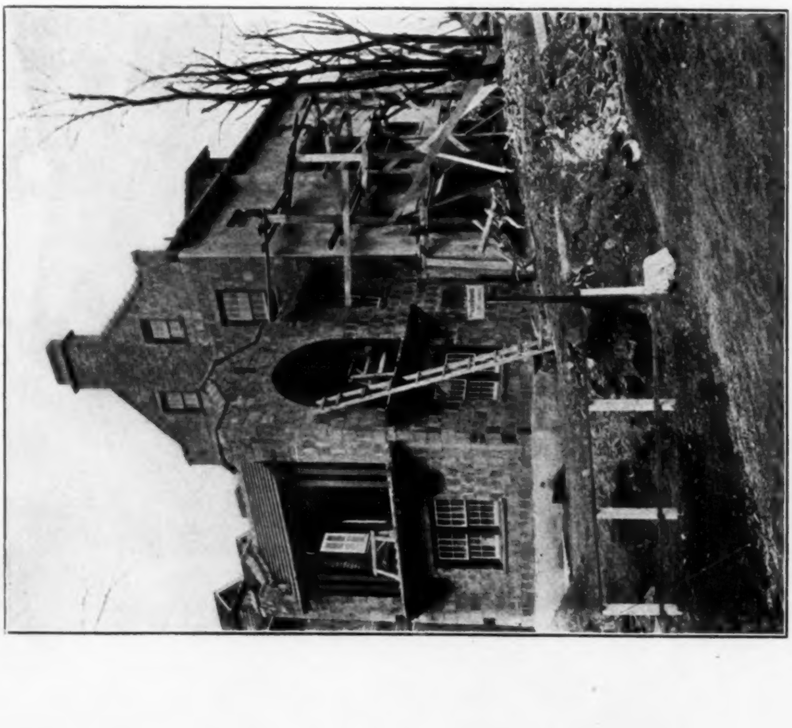
Lawrence, Long Island. Ford, Stewart & Oliver, Architects.

A good example of the hollow tile house, with roof of the same fireproof construction. This form of construction, though expensive in first cost, makes about as fireproof and as comfortable a house to live in as we know how to build. The extensive use of concrete is to be noted, especially in the detail of the roof construction here shown.

Fahrenheit; those most commonly used in walls are about 8 inches deep, 12 inches wide and 12 inches high, and, on experimental tests, have been found to possess a crushing strength along their height of over 3,200 pounds to the square inch of material in the cross-section, which allows for a very generous factor of safety in the walls and floors where they are used. Walls and floors so built are accordingly 8 inches thick, in addition to the thickness, in the case of walls of half an inch of plaster for the inside and an inch or more of cement for outside protection from the weather. The floors are then plastered on the under side with about half an inch of plaster, as is the inside of the walls, and the upper side of the floor may be treated as preferred. Colored tile, laid in cement, may be used, a white or colored cement-finished floor alone may be adopted, or a wood floor may be laid on wood strips embedded in several inches of cinder concrete placed on the structural floor already described. The last method makes a good sound-proof construction.

So much for walls, floors and ceilings, but what about roofs? Are they built in the same way as the floors and of the same materials? They may be so built, but except in houses of more than average extent and cost, they may become very expensive if built of fireproof materials. The house of Mr. Francis C. Huntington, at Lawrence, Long Island, which is shown herewith in course of building, shows a fireproof tile roof with widely spaced concrete rafters. The detail of the roof construction at the bottom of the page shows clearly how the materials are put together, but it fails to reveal the hidden steel rods and the concrete filling in the courses of tile, the reinforcement which the spacing of the concrete rafters requires in order to give the construction rigidity. The difficulty of building such a roof and the extra steel and concrete required to unite its tile courses with its rafters is considerable, though, of course, practically indestructible when finished.

The cost of roof construction for the fireproof house is admittedly at present the stumbling-block in its progress. There are two alternatives besides the solution just described. One of these consists in using a timber framework and covering the outside with a fireproof material, such as clay tile, or, in cheaper houses, with one of the composition tiles lately placed on the market. This form of roof, from a fireproofing standpoint, is only partially successful, as it does not preclude the possibility of destruction by a fire that might originate from a defective chimney at a point between the uppermost fireproof floor and the roof, or from other causes in the space enclosed by the roof and entails, moreover, roof repair bills from which the fireproof house desires to escape. Pitched roofs built in the same way as the concrete and tile floors already described are possible only in gable roofs where the concrete beams may rest on the inclined sides of the tile gable walls. It would be impracticable to employ this form in a roof of another design, a peaked roof, for example. In such a roof it would again be necessary to revert to the expensive and highly reenforced type with widely spaced and deep concrete rafters as in the Huntington house mentioned above, which, except in the larger houses, is prohibitive in cost. All the smaller tile houses which are illustrated in this issue, with one exception, have wooden roofs with a fireproof exterior covering and are consequently only partially successful as permanent structures. The exception is the little house in Caldwell, which has already been referred to. There we find the other alternative, the flat roof. This may be built in the same way as the tile and concrete floors, or entirely of a thin reinforced concrete slab with deep widely spaced reinforced concrete girders from which the ceiling of the uppermost floor is suspended, thus affording between girders a ventilating space for the sleeping rooms. The reinforced concrete slab form has been employed in the Caldwell house. A circulation of air is achieved through circular holes under the eaves, which may be faintly distinguished in the photograph. If the regular tile floor construction of alternating rows of tiles and reinforced concrete



The residence of Mr. A. L. Schaeffer, Engineer of the Public Service Commission, at University Heights, New York City, is here shown in two views, one taken before the application of the outside cement finish, the other after the work was entirely completed. This was the second hollow tile house to come under the jurisdiction of the New York Building Department. The side walls are of 8-inch and 10-inch hollow tile, with arches formed of common brick, floors of 8-inch hollow tile. The masonry was erected for less than $3,000, and was not waterproofed, showing no dampness as a result. The costly interior woodwork makes a per cubic foot cost misleading, and is therefore omitted.

beams had been used instead of the solid concrete slab, it would have been necessary to carry the concrete beams below the bottom face of the tiles in order to obtain the airspace. Either form of flat roof fireproof construction is, of course, cheaper than the pitched roof types hereinbefore discussed and the flat reinforced concrete slab is the cheapest and most practical of all. Moreover, the flat roof built entirely of fire-proof materials seems the inevitable solution of the roof problem for the fireproof house. Being entirely weatherproof, if properly built, there can be no question of the need, in a northern climate, of a pitched surface to shed water and snow. Secondly, being of materials which are much more proof against extremes of temperature than a roof whose basis is wood, a small airspace with a free circulation of air is all that is necessary to protect the rooms under it from excessive temperature radiation. The flat roof also is much the easiest to build and requires, of course, less material than any form of pitched roof. There seems no practical reason, therefore, why fireproof houses in the future should not have flat roofs. True, there is no precedent in the history of architecture for the flat roof. There could be none because the conditions which are tending to produce it to-day have never before existed. Perhaps, if the reinforcing of concrete and the use of structural steel in connection with the flat arch had been sooner discovered, the fireproof country and suburban house with a flat roof would be an utterly commonplace type for us of the twentieth century. It is interesting to speculate what would have been the course of the Renaissance in architecture if these inventions had been made four or five centuries ago. The flat roof done brutally and *ad infinitum* in our suburbs would be the finishing touch to their already deplorable lack of comity. But in the hands of an artist there seems no reason why this feature should not be made architecturally interesting besides highly popular and useful. Useful it might be in summer as a cool and airy retreat, especially in localities where the houses are close together and scantily provided with piazzas. As the fireproof roof is amply capable of bearing any ordinary live loads that might be brought to bear upon it, why not take advantage of it as an outdoor sleeping room and roof garden, as was proposed by the architect of the prize-winning design for a sanitary workingman's cottage of cast concrete, recently published in the magazines.

That the problem of roof construction and its architectural treatment for the house built entirely of fireproof materials is as yet in an undecided state, there can be no question. What the ultimate outcome will be it is still impossible to foretell with any degree of certainty. Attempts have recently been made to simplify the construction of all-concrete pitched roofs by casting the rafters in a horizontal position on the uppermost floor and when properly set hoisting them into position and in one operation casting the abutting ridge piece and the eaves below. The concrete slabs which fill the wide spaces between rafters have meanwhile been cast on the ground and are ready to be placed in position and properly cemented to the rafters and to each other. This method has thus far proved economical and entirely satisfactory structurally and practically.

Hollow tile construction cannot be entirely of tile as its name implies; it would be as impossible to build a house entirely of hollow tile as it would be to build it of newspapers. In the tile houses, concrete forms about a half of the material in the floors besides the door and window lintels. Hollow tile as used in this form, a collection of hollow prismatic blocks, is admirably adapted to resist a crushing stress, but not at all to withstand bending action as in bridging over an interval, a floor or a door or window opening. It is possible to employ in the floors and over openings a specially made flat-arched tile with skew-backs abutting the girders and rafters, as in the ordinary city fireproof floor construction. But this type of tile construction is prohibitive in cost, requiring a high grade of labor, and has

for that reason been simplified for the inexpensive country and suburban houses by the type of small reinforced concrete girders with their alternating courses of tile supported by adhesion to the concrete, as described above.

The future of hollow tile as a structural material in the dwelling house is largely dependent on the possibility of further simplifying its handling and thereby materially reducing the first cost of building, so as to enable successful competition against frame and other forms of non-fireproof construction. Experience thus far with hollow tile as a structural building material warrants the opinion that it has proved eminently successful wherever material and workmanship have been of good quality. Where either material or workmanship has not been of the best the results have been proportionately inferior.

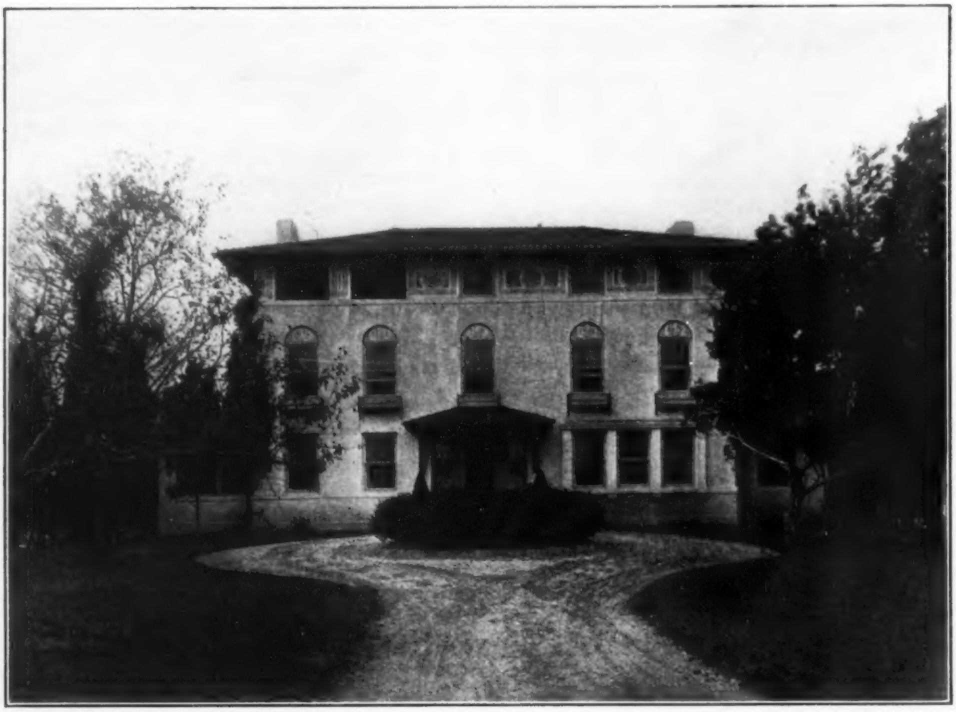
Concrete as a material is not only admirably adapted to resist crushing, but when reinforced its steel sinews render it an equally good resistant to bending. It has recently been demonstrated, moreover, that it is entirely feasible to build a solid weatherproof wall of concrete, but concrete construction will continue to be out of the range of possibility as a popular building material for dwellings, for the reason that a technical knowledge of construction and of the material is absolutely requisite to its successful employment.

The nature of fireproof construction applied to dwellings is such that its progress cannot be expected to be sudden and rapid. The advantages which it carries over the non-fireproof constructions are obtained only by exercising greater care in those matters of design and workmanship which can readily be and are slouched in country and suburban building. The fireproof house involves a greater degree of conscience on the part of all parties involved. It demands that the owner consider seriously the idea of building permanently at an increased first cost, though to an ultimate economy. It requires a higher grade of workmanship and absolute uniformity and integrity in the quality of the materials employed. Lastly, it requires the utmost thorough knowledge of materials and their structural application, besides the closest supervision during the progress of the work. It is only through the wholehearted co-operation of these factors that fireproofed construction for dwellings will play its destined part in the development of building and architecture in this country.

H. W. Frohne.

HOLLOW TILE HOUSE AT BABEL, CONN.

Squires & Wynkoop, Architects.



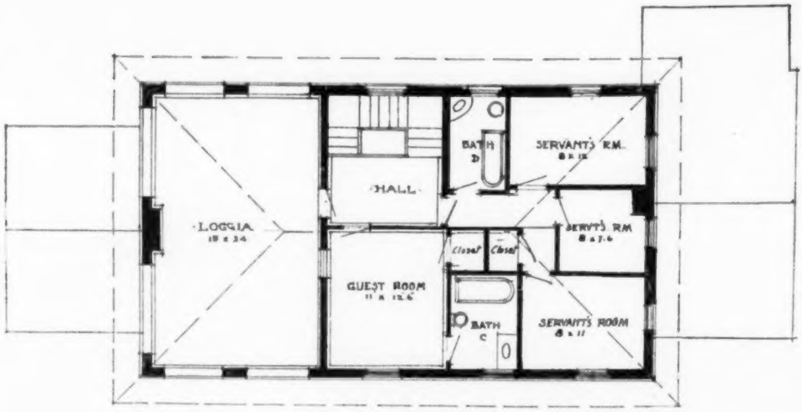
HOUSE NO. 1 AT CEDARHURST, LONG ISLAND.
Louis Boynton, Architect.

The three houses at Cedarhurst, Long Island, illustrated on this and succeeding pages, are of that class costing from $10,000 to twice that sum. They are of semi-fireproof construction, the walls and first floors being of hollow terra cotta blocks with concrete beams. Exterior walls are finished with cement mortar. The roofs are of red Spanish tile on wood rafters. With substantial but simple interior finish their cost (about twenty-six cents per cubic foot) is little above what it would have been if frame construction had been used throughout. The structural work was done by contractors who were thoroughly reliable and familiar with the use of terra cotta blocks.

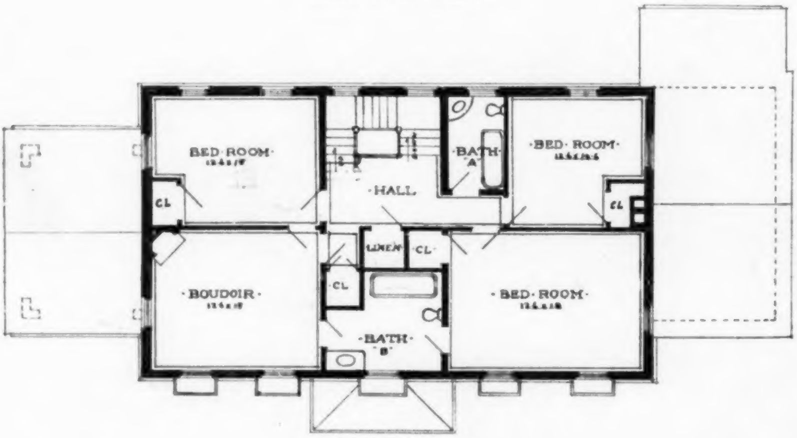
One of the most noticeable features in two of these three houses is the decoration which has been applied to the walls. The architect, after experimenting with various methods of applying color to a cement surface, finally hit upon the method which has resulted so successfully in the two houses above mentioned. The process consists in using earth colors, such as Siena, yellow ochre and Indian red, mixing them with a white cement as a medium and applying the mixture with brush and stencil. The application was made within ten days after the walls were finished and a severe test was encountered in the form of a driving rainstorm, about twelve hours after a part of the work had been executed. The result was entirely successful, the colors having set hard and firm in the cement.

The work, which cost about $200 for both jobs, was executed by a skilful interior decorator, and the effect is remarkably like that of old Italian fresco work. It may be faintly dis inguished on the illustration above, over the second story windows and between those of the third story. The effect that has been obtained by this decoration is simply one of the numerous instances which prove that it is not the expensive house which possesses the qualities which we all admire. It is the house which is the product of intelligence and skill in using the means at command. No doubt, under uninstructed guidance many times two hundred dollars could have been spent in decorating these two houses without achieving anything but an absolutely redundant and repugnant effect.

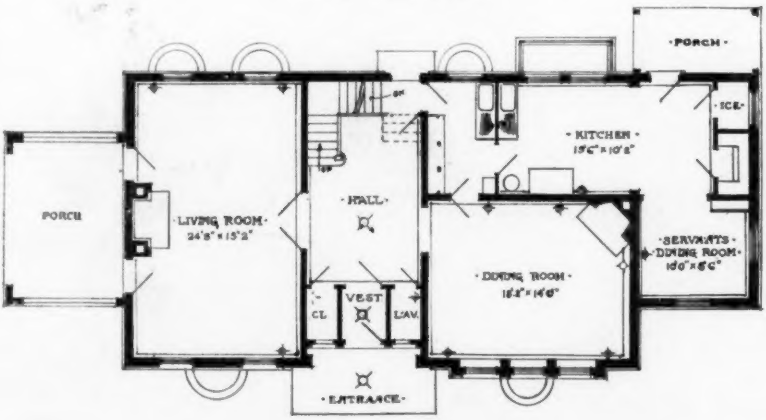
326 THE ARCHITECTURAL RECORD.



Third Floor Plan.



Second Floor Plan.



First Floor Plan.

TILE HOUSE NO. 1 AT CEDARHURST, LONG ISLAND.

Louis Boynton, Architect.

The novelty of this plan consists in the large amount of space in the third floor, which accommodates not only the servants but contains as well a guest room with bath and a spacious loggia or roof verandah, an ideal outdoor room in summer.

TILE HOUSE NO. 2 AT CEDARHURST, LONG ISLAND.

Louis Boynton, Architect.

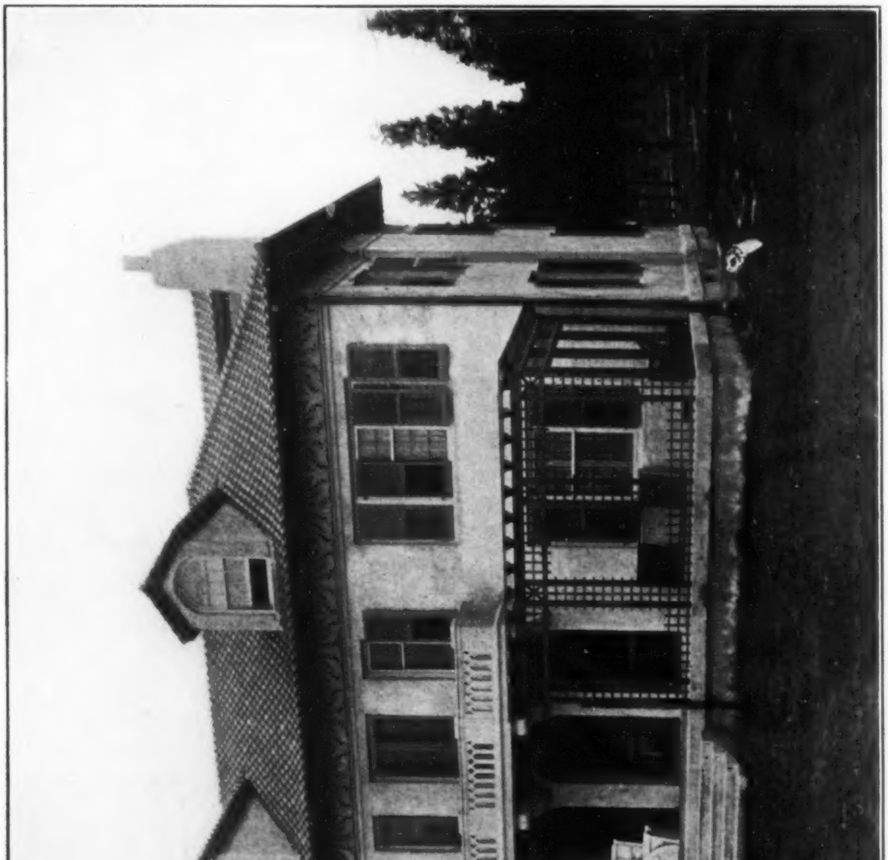
This house has been included in our illustrations of fireproofed dwellings, not because it presents any particularly pertinent architectural rendering in incombustible materials, but rather for its generally charming aspect. In fact, its design is not well adapted for the methods of fireproof construction.

Second Floor Plan.

First Floor Plan.

TILE HOUSE NO. 2 AT CEDARHURST, LONG ISLAND.

Louis Boynton, Architect.

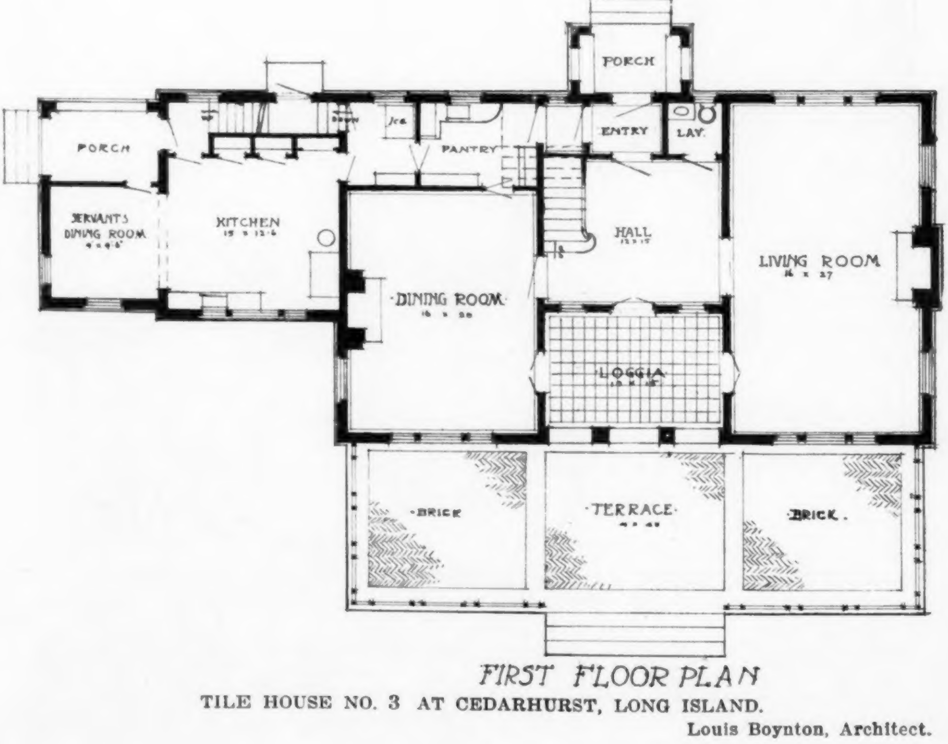


TILE HOUSE NO. 3 AT CEDARHURST, LONG ISLAND.

Note the simply decorated cement frieze under the eaves, more fully described on page 324.

Louis Boynton, Architect.

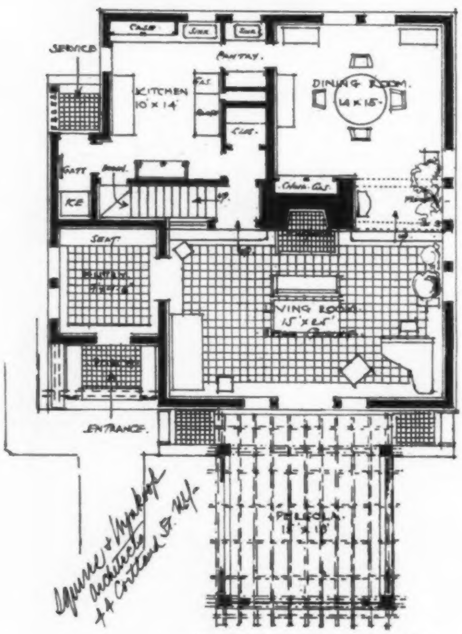
SECOND FLOOR PLAN



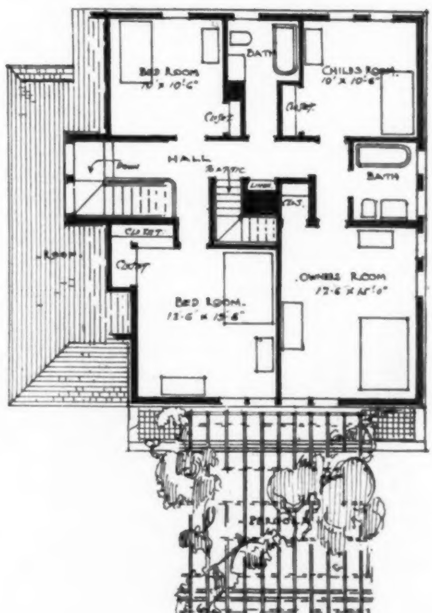
FIRST FLOOR PLAN

TILE HOUSE NO. 3 AT CEDARHURST, LONG ISLAND.

Louis Boynton, Architect.



-FIRST FLOOR PLAN-

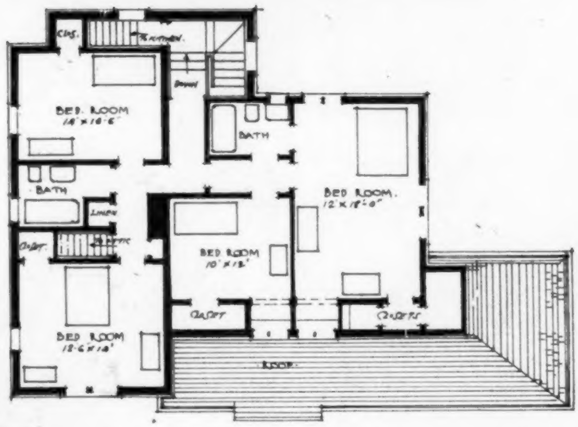


· SECOND FLOOR PLAN ·

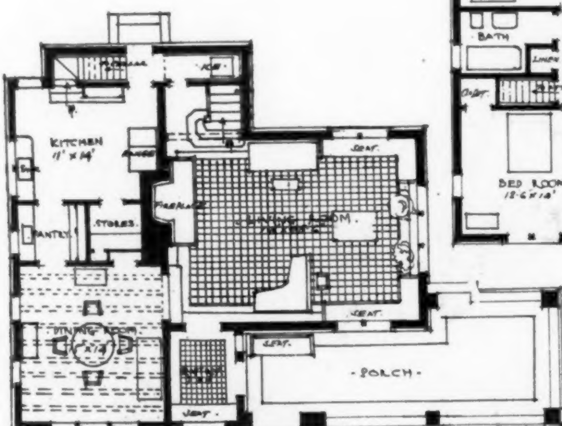
HOLLOW TILE HOUSE AT MOUNTAIN STATION, ORANGE, NEW JERSEY.

Squires & Wynkoop, Architects.

This house is one of the Fireproof Village, the largest group of this type of houses so far erected. The construction is of hollow tile for walls and floors, first floor finished in quarry tile, and frame roof covered with asbestos shingles. The cost, exclusive of plumbing, heating and lighting, is about twenty cents per cubic foot.



·SECOND FLOOR PLAN·

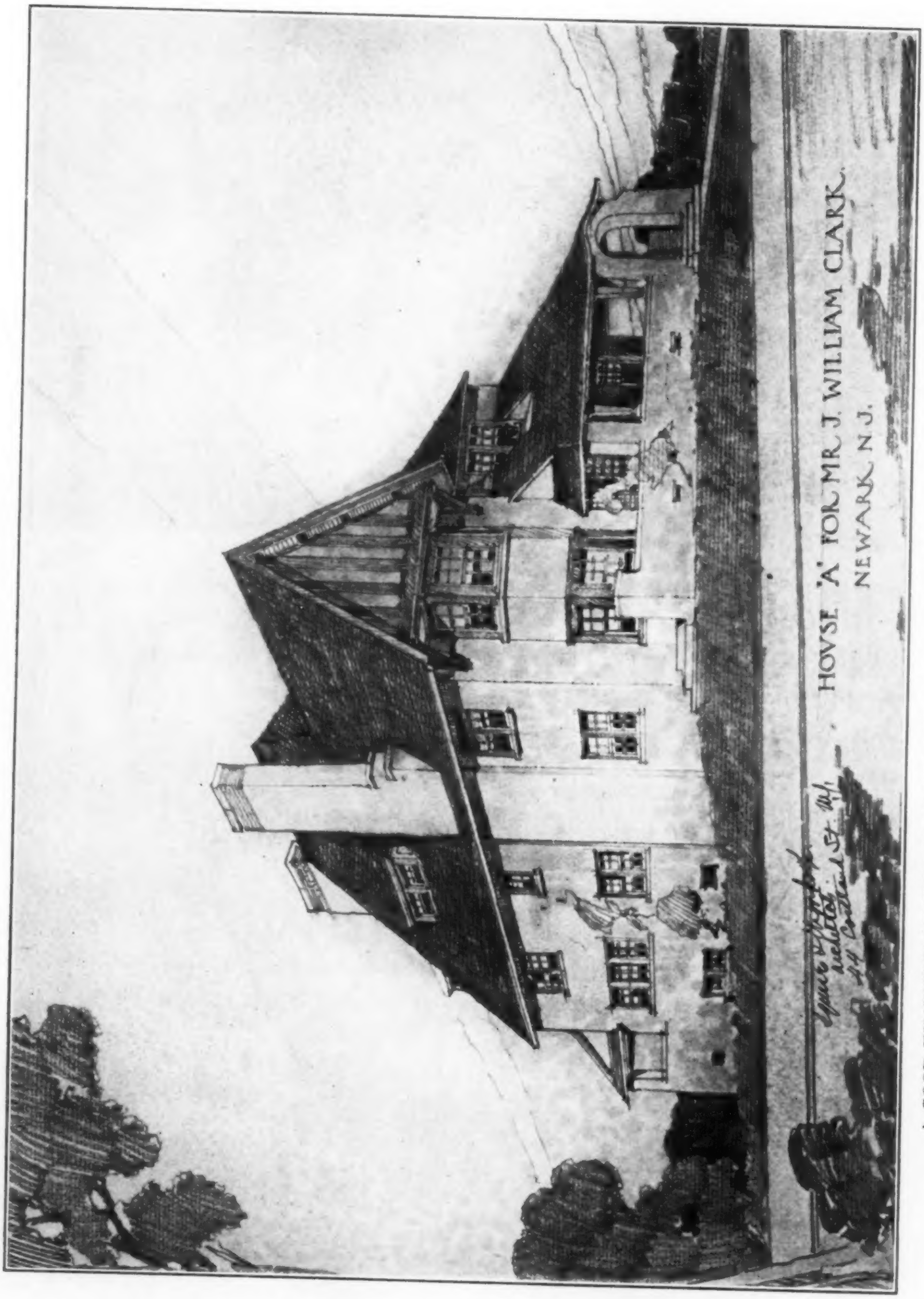


·FIRST FLOOR PLAN·

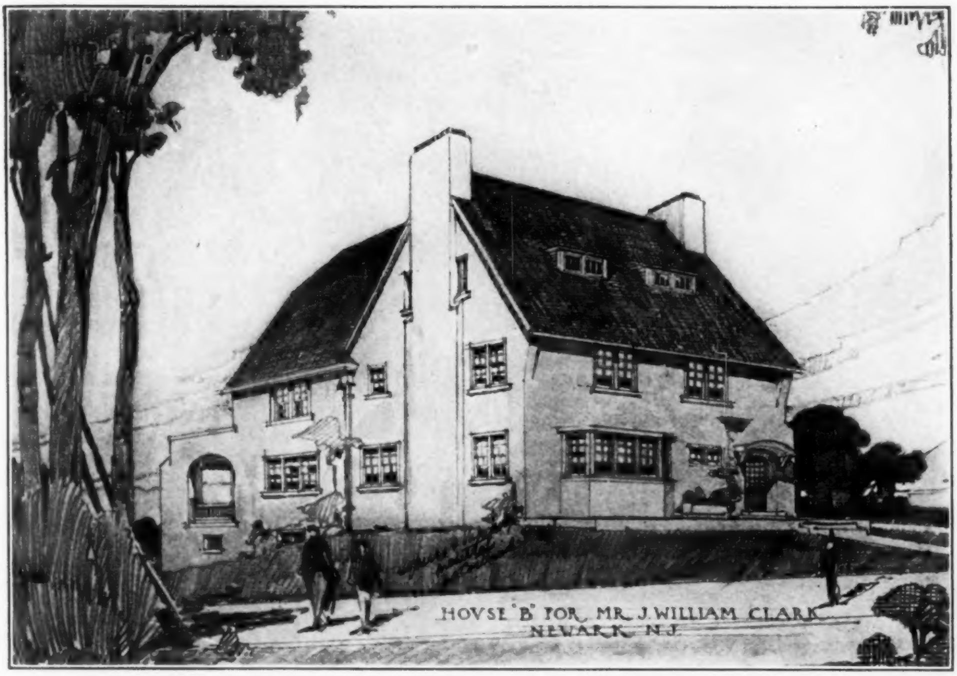
TILE HOUSE AT MOUNTAIN STATION, ORANGE, NEW JERSEY.

Squires & Wynkoop, Architects.

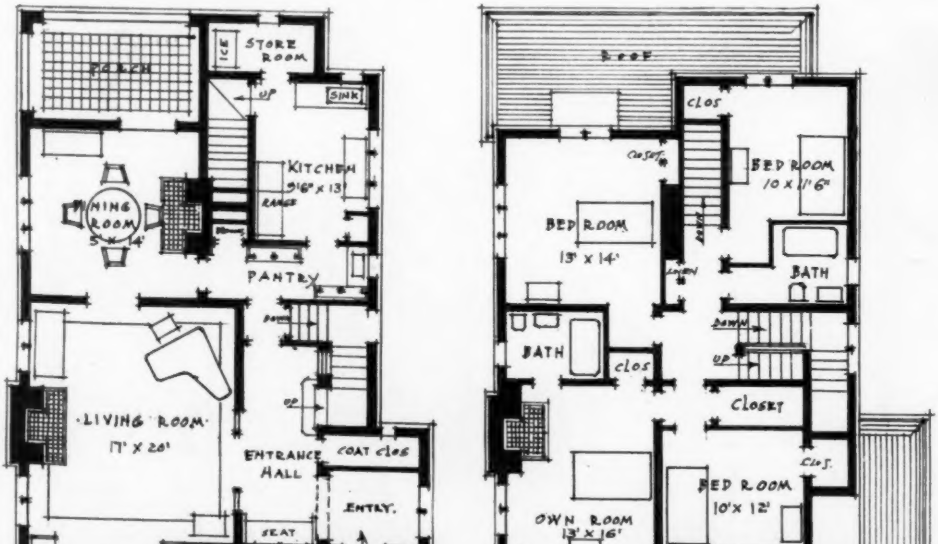
Another house from the Fireproof Village. The most notable feature of this house is its large living room (18 ft. by 25 ft.). The span of 18 ft. is here carried on the ordinary type of concrete beams 8 ins. deep and 4 ins. wide, with alternating courses of 8-in. hollow tile, showing the structural advantage of the materials. The cost of this house for the construction, that is, without plumbing, heating and lighting, is about twenty cents per cubic foot.



A GOOD EXAMPLE OF THE HOLLOW TILE HOUSE WITH ROOF AND ATTIC FLOOR OF WOOD.

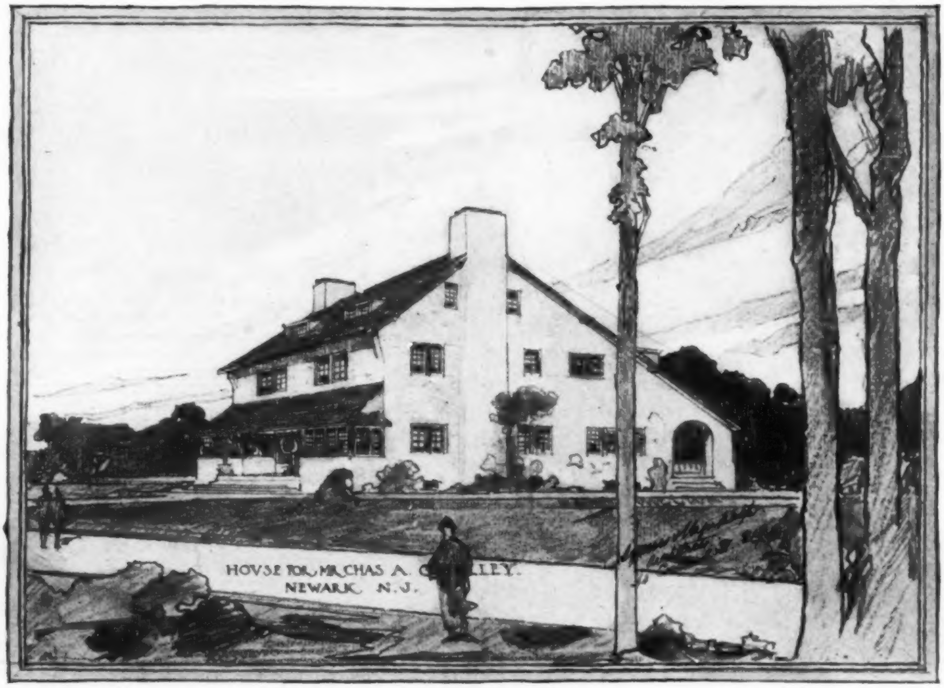


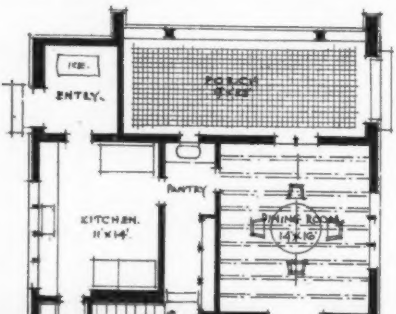
This house and the one on the opposite page are the beginnings of an extensive settlement of fireproof houses.



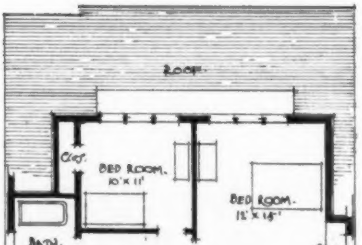
HOUSE FOR MR. J. WILLIAM CLARK.

Newark, N. J. Squires & Wynkoop, Architects.





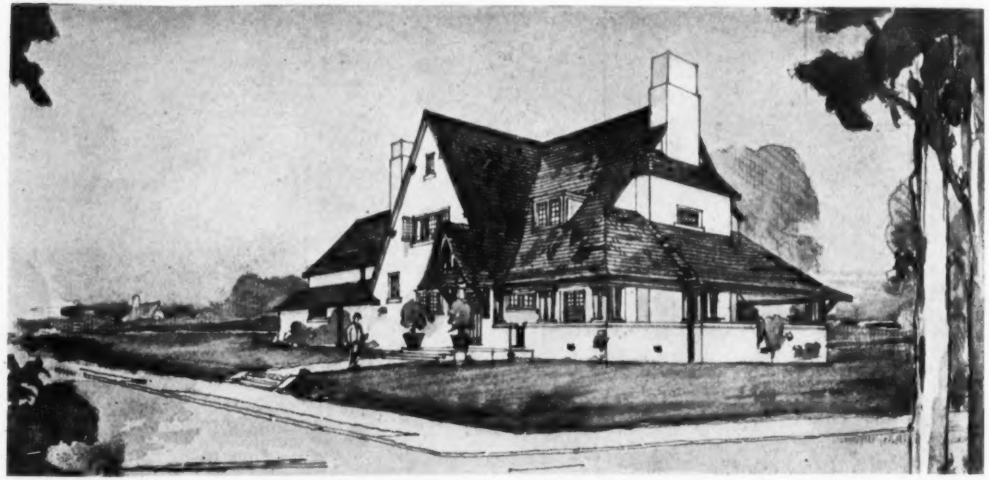
. FIRST FLOOR PLAN .

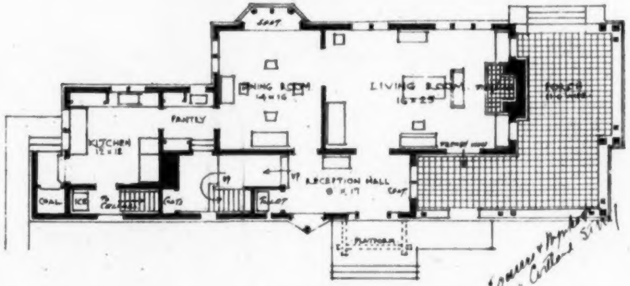


. SECOND FLOOR PLAN .

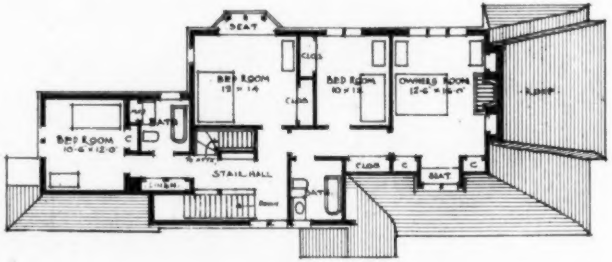
This house is at Hedden Terrace, Newark. It has tile floors, side and bearing walls, and a tile roof on wood beams and sheathing. The concrete beams are exposed where shown in the plans. The building is expensively finished and cost twenty-six cents per cubic foot. The design is one easily constructible in tile.

Squires & Wynkoop, Architects.





·FIRST FLOOR PLAN·



SECOND FLOOR PLAN

TILE HOUSE FOR MR. EDWARD D. PAGE.

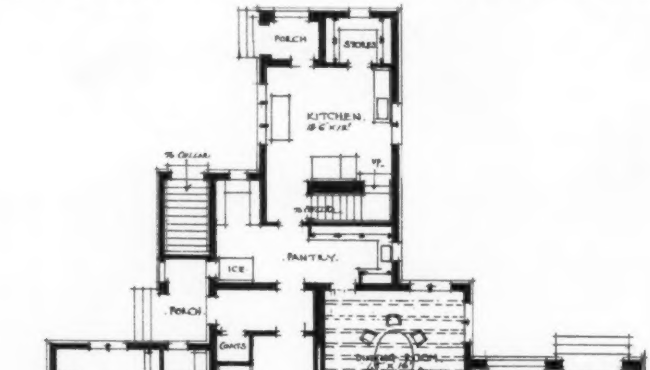
Orange, N. J. Squires & Wynkoop, Architects.

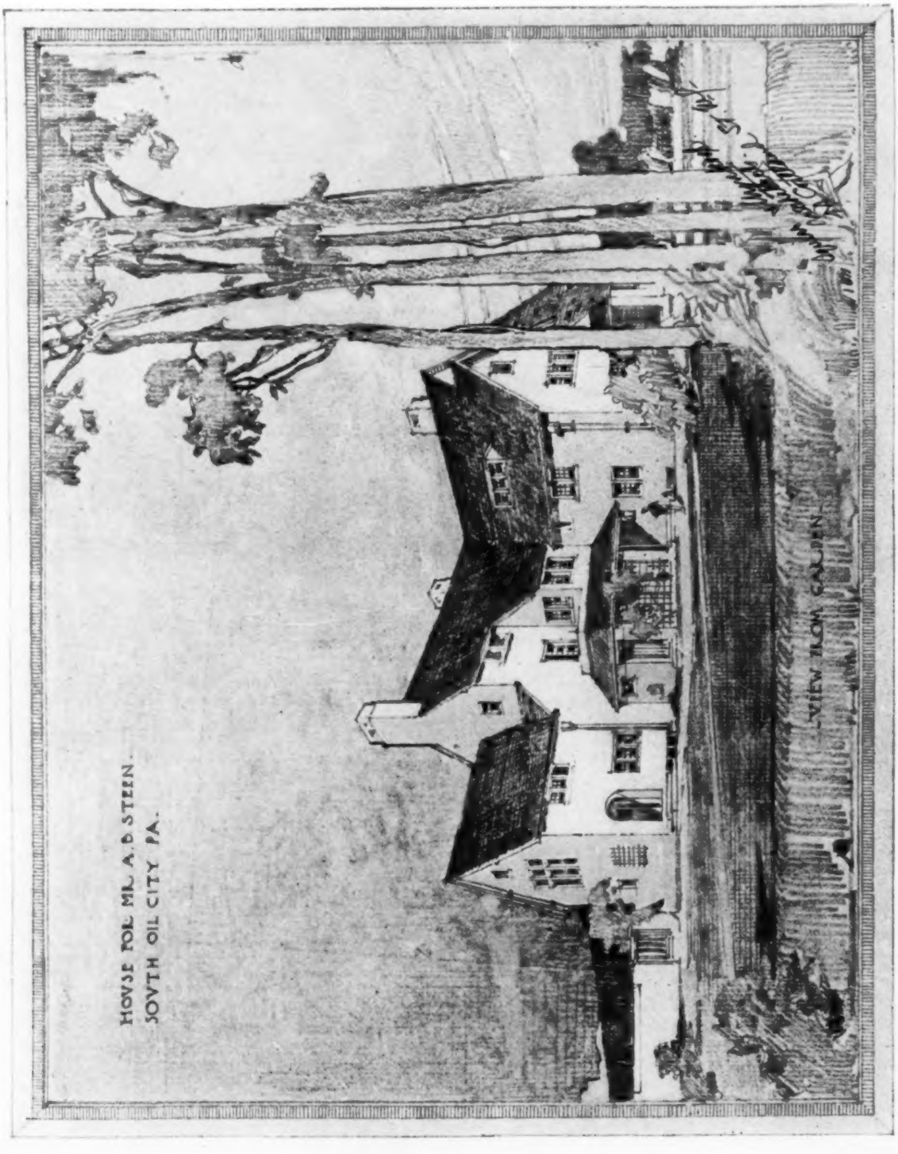
The plan shows the difficulties encountered in a house with a north entrance.

Two tile floors, tile outside bearing and partition walls, asbestos shingle roof on wood sheathing and beams, and wood joists in third floor. Cost twenty-two cents for construction only.

Hollow tile floors throughout; tile roof, 8-in. hollow tile bearing and outside walls, three hollow tile non-bearing walls. The possibility of a free use of fireplaces shows an advantage of this construction.

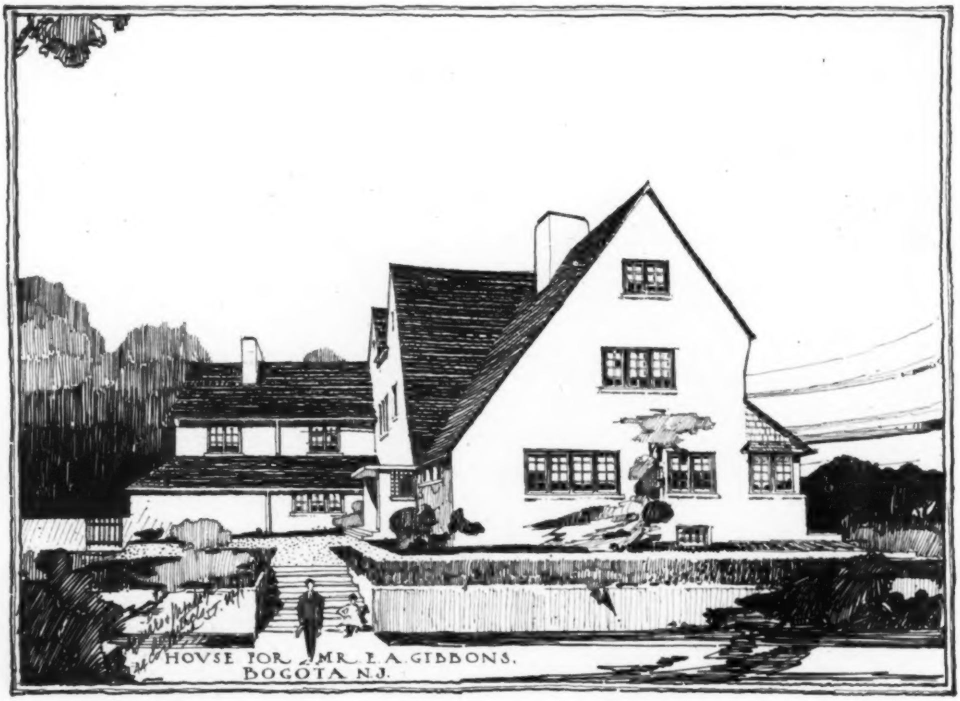
In hollow tile construction it is possible to locate fireplaces wherever it is most convenient to have them on any floor, regardless of what lies underneath on the floor below. That is, the smoke flues may start on any floor and do not have to run down into the cellar.

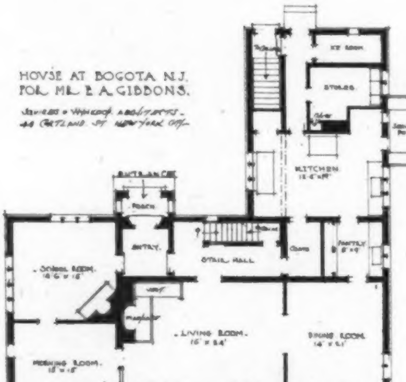




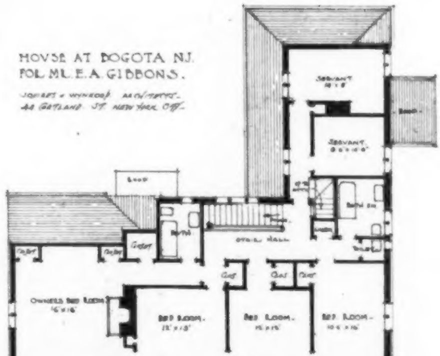
This is a house for a mechanical engineer who wished to have a building as nearly fireproof as possible. Flatter roofs were impossible owing to climatic conditions.

Squires & Wynkoop, Architects.



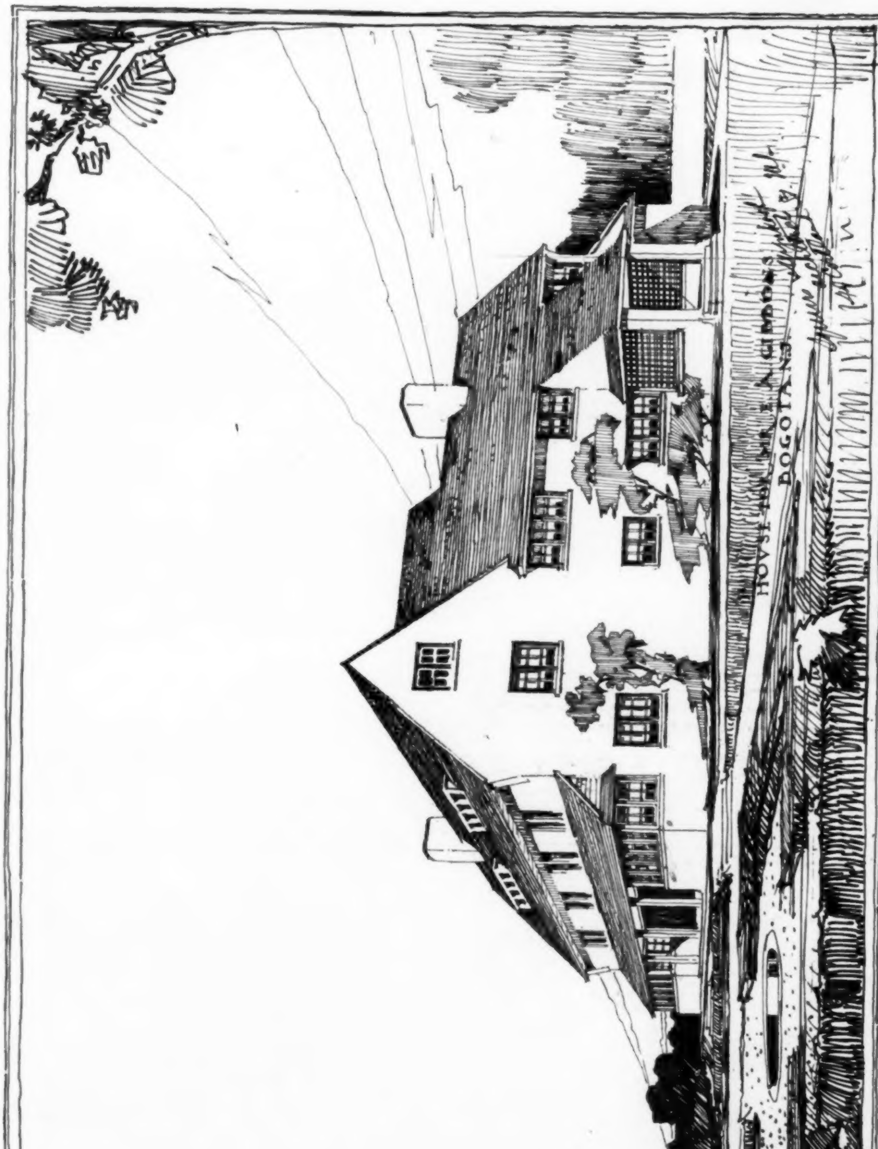


GARDEN.
FIRST FLOOR PLAN.

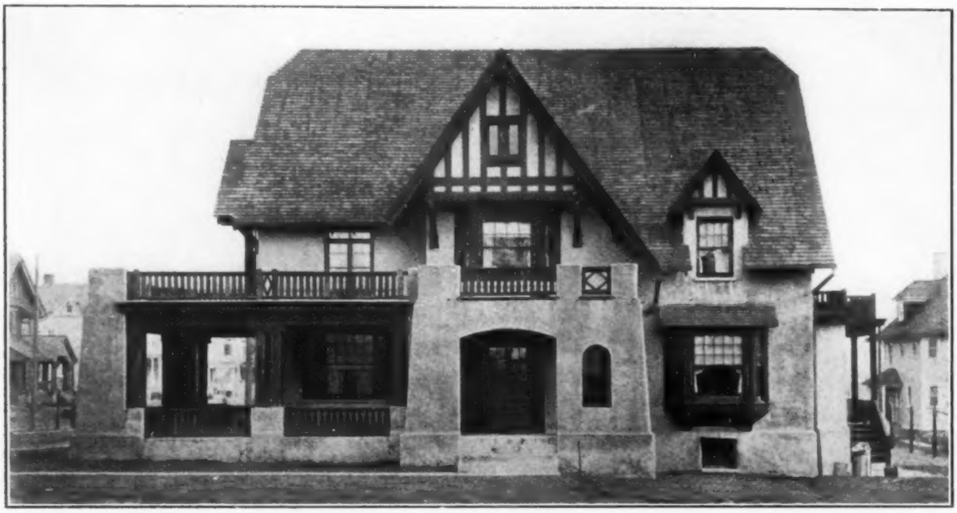


SECOND FLOOR PLAN.

All floors are formed of 9-in. beams, which project 3 ins. below the tile filling and give the effect of a beamed ceiling. All floors are either of concrete or marbleloid. All roofs of roofing tile. The building is as nearly fireproof as is possible with this type of roof. Exterior walls are not waterproofed, and have shown no dampness. Considerable vertical steel reinforcement has been used. No cap flashing was used on window sills, but an incision was made in the cement, the copper burned in and cemented with white lead.



Bogota, N. J. HOUSE FOR MR. E. A. GIBBONS. Squires & Wynkoop, Architects.



RESIDENCE OF PROFESSOR LOUGH.

University Heights, New York City. Squires & Wynkoop, Architects.

This was the first terra cotta hollow tile house built in New York City. Construction, hollow tile floors and walls, waterproofed. Attic floor of wood joists. Cost about twenty-one cents per cubic foot.

HOUSE FOR DE WITT HUBBELL.

Plainfield, N. J. Squires & Wynkoop, Architects.

Two hollow tile floors. Designed for economy, and cost between seventeen and eighteen cents per cubic foot. Tile was erected by a local mason, who had seen only one tile house, and that only once.

Architectural Development in the Reinforced Concrete House

Reinforced concrete has been enthusiastically called a plastic building material. This is only partly true. Its initial plasticity and the widely different properties of its two component elements, steel and concrete, the one of great tensile and the other of great compressive strength, have given to the designer a far wider scope than he has ever enjoyed in any other building material. This scope has, however, very sharply defined limitations, and he who solves successfully the problem of concrete design, be his method that of the drafting board, or, better, of the modeling table, must have absolute knowledge of the engineering limitations and necessities of the material with which he is dealing, if his work is to be possessed of any real engineering character and architectural beauty.

No branch of art owes more to the past than architecture. It is only natural that the architects of to-day who are, as a class, worshippers of the marvelous beauties that their craft has left to mark the glories of by-gone times, should be slow in adopting a new building material, one that in its nature requires the breaking away from ancient precedent and design and the originating of a new architectural type.

The bolder spirits in the profession, who see the opportunity of great artistic and financial reward in the solution of the problem of artistic concrete construction, will, of course, have to stand the derisive criticism with which conservatism has always attempted to check development.

Thus, a recent writer in this magazine refers to a reinforced-concrete bridge in the New York parkway system as being "unduly thinned and unduly flattened by means of the concealed reinforcement." Unduly only—for a masonry bridge! But the beauty of concrete lies in its power to function differently from stone. Nor is its reinforcement "concealed." Unlike structural steel, the steel of reinforced concrete is not concealed, and is not meant to be. Reinforced concrete is a homogeneous material, either element of which is indispensable, and to the seeing eye well-designed works in concrete always show the steel, and, to a large extent, even the amount of steel used in the reinforcement. That architectural design which fully satisfies the structural demands of the material and *expresses them to the eye,* comes nearest to beauty.

The same principle of respect for the real structure would apply to another remark in the same article on some concrete walls as "mere inexpressive expensive expanses of smooth smears"! To the person who understands how full of life, in the sense of strains met and pressures sustained, a concrete wall really is— that it is never, as it has been called, a "curtain wall" between points of support — those "smooth smears," susceptible, as they also are, of immense variations in texture, carry great possibilities of beauty.

Just what style will be evolved as a proper and fitting expression of reinforced concrete only time will tell. One thing we may be certain of—it will not follow the lines of masonry in stone or brick, nor of construction in steel or wood, except in so far as its own principles of construction are identical. In my opinion, the future of concrete architecture lies where that of all other types has lain—in the logical development of the engineering possibilities of the material, modified only by conditions of labor. It is, of course, well known that the first beginning of modern architecture in the Romanesque recessed arch and the Gothic pointed vault was the need of economy in the use, for larger structures, of smaller stones than earlier builders had had. It was, so to speak, in silence and shadow, in obscure corners, in response to direct need, that these epoch-making innovations were made, and it is to me, at least, of direct and striking in-

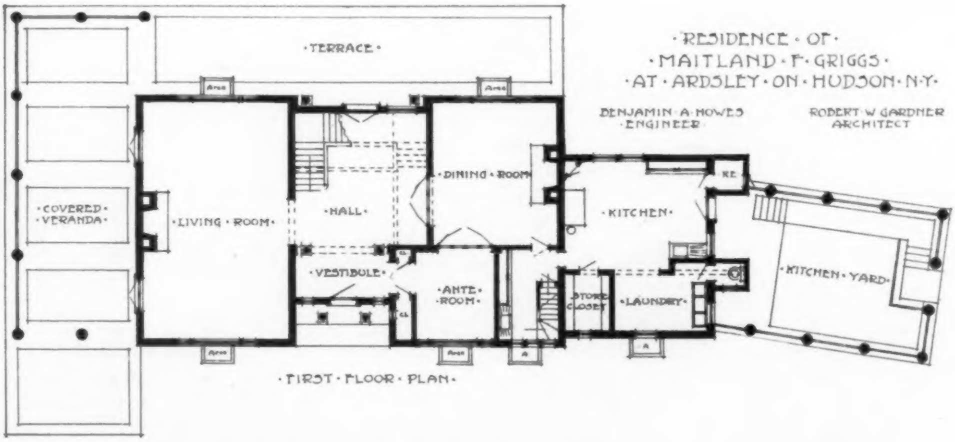
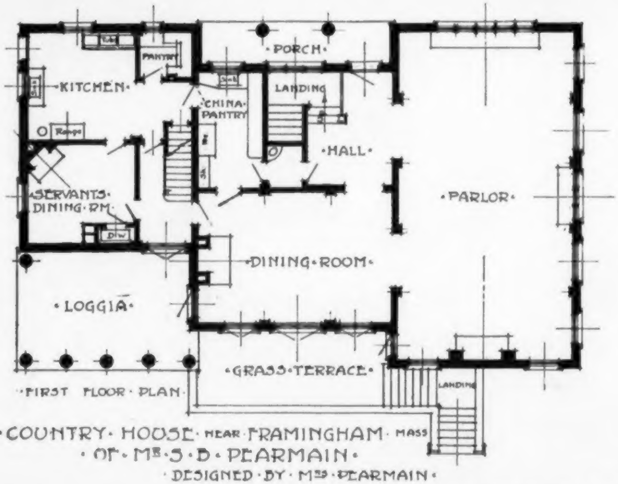


FIG. 1. RESIDENCE OF MAITLAND F. GRIGGS, ESQ.

Ardsley-on-Hudson, N. Y.
Benjamin A. Howes, Engineer.

Robt. W. Gardner, Architect.



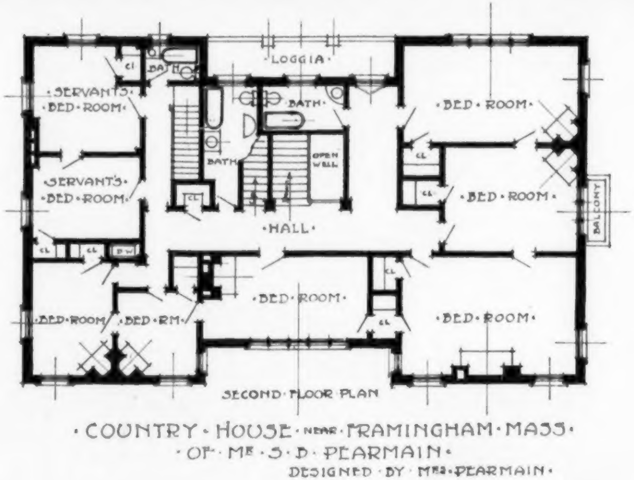


FIG. 2. RESIDENCE OF SUMNER B. PEARMAIN, ESQ.

Framingham, Mass.
Benjamin A. Howes, Engineer.

Designed by Mrs. Pearmain.

terest, that in the same way, in direct response to necessity, that the first steps have been taken toward a real reinforced concrete architecture. It is in factory and warehouse construction, the work of those blind utilitarians, the building engineers, that you will find them.

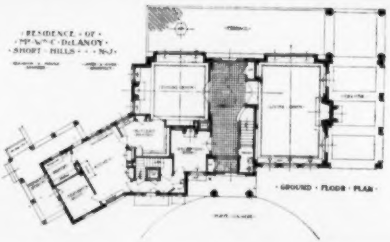
A typical case is the transition from beam and column to the flat arch. The point of weakness in a concrete girder is not, as is generally supposed, at its center, but at the so-called shearing point, where the beam joins the column. To increase the strength of beam at this point the bracket is utilized, passing over easily into the flattened arch, which also does away with a considerable quantity of waste material at its center, that serves no other purpose than extra fireproofing of the steel reinforcement. Thus the flat arch, which is only a curved beam, is the logical form for the concrete roof support. To-day, any building of reinforced concrete, of the least monumental importance, will be a composition of which the flat arch is a dominant motif, and of which we have an example in the noble pile of the Munich School of Anatomy.

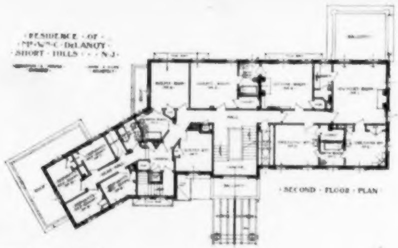
This case of the flat arch is, however, but a single instance of the way in which engineering logic establishes an æsthetic type. I believe that it is one of many such points of departure for creative design in concrete. But as my subject is not concrete architecture in general, but concrete houses, I will pass on to the variations from the usual type which economy and engineering have demanded and will demand for the construction of dwellings.

The following is not primarily theoretical. It is based on several years' experience in the use of reinforced concrete for country houses. It has become the practice, within the last few years, to refer to houses in which cement mortar has been used in the form of blocks or exterior plaster as "concrete" houses. It need hardly be said that the following considerations do not refer to such structures, which are of ordinary frame or masonry construction, and present no new engineering or architectural problems; they refer only to reinforced concrete, used as such for the structural parts of the house, particular emphasis being laid on the fact that stairways, floors and roofs are of reinforced concrete, and partitions of standard fireproof construction. Not what may be done, but what has been successfully done, is the subject of this record, with accompanying deductions as to future progress.

First and most striking of those variations which experience has shown to be desirable is the flat, or nearly flat, roof (Figs. 1, 2, 3). It is the logical concrete construction, being much cheaper than the sloping roof of concrete, or tile on concrete skeleton. In general, it is cheaper to build walls than steeply pitched roofs. The reasons which impel us to cling to the pitched roof are largely traditional. We have come from rural dwellers, whose families have needed storehouse rooms, or we have taken the fashion from northern climates, where a flat roof in local construction could not sustain a heavy fall of snow. But with the change to more highly organized conditions, less attic space is required, and a well-constructed flat roof in concrete sustains any weight without leaking. The appearance of the many gabled roof is supposed to be more attractive; but it is really necessary, from an æsthetic point of view, only to houses whose height is otherwise out of proportion to their width, to bring them down, as it were, by the suggestion of downward slanting lines, as in the high-shouldered houses of old German towns. Henry James' dictum that a house should sit down, not stand up, is perfectly met by the lines of these reposeful structures. The last (Fig. 3) is really a flat-roofed house; that is, the greater portion of the roof area is flat, while only a small part slopes.

But appearance and structural logic alone cover only half of what may be said for the flat roof. It is found to be the most refreshing and attractive spot in the house. The house in Fig. 2 is in the deep country, where it might be thought that one would prefer real out-of-doors on veranda or lawn; but the roof has proved to be the family center of en-





Short Hills, N. J.
Benjamin A. Howes, Engineer.

FIG. 3. RESIDENCE OF WILLIAM C. DELANOY, ESQ.

(Photo by A. Patzig.)

John A. Gard, Architect.

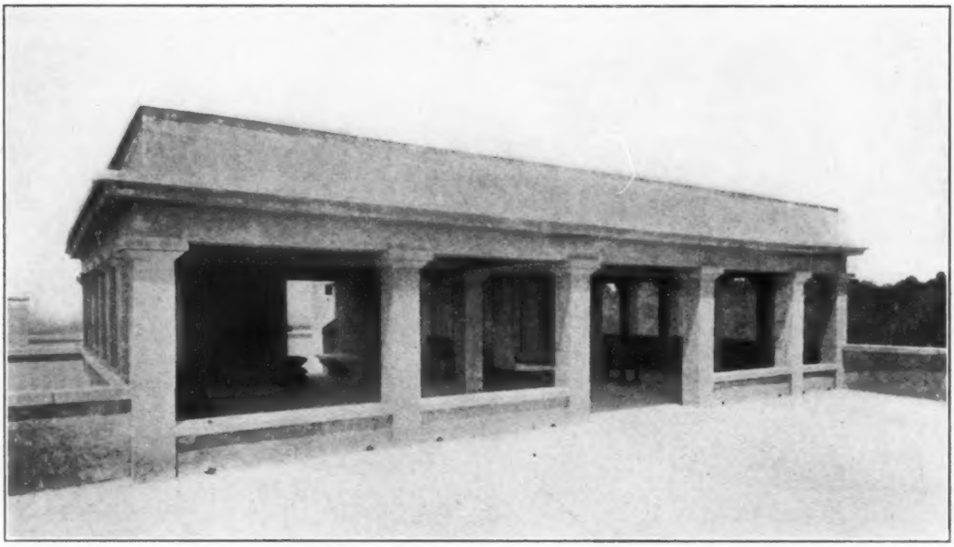


FIG. 4. ROOF LOGGIA WITH FIREPLACE—PEARMAIN HOUSE.

FIG. 5. ROOF LOGGIA WITH FIREPLACE—DELANOY HOUSE.

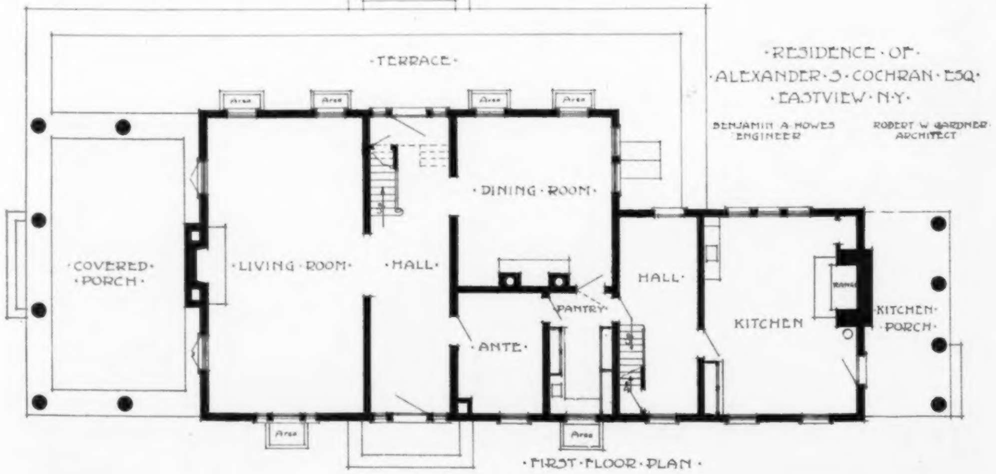


FIG. 6. RESIDENCE OF ALEXANDER S. COCHRAN, ESQ.

East View, N. Y.

Benjamin A. Howes, Engineer. **Robt. W. Gardner, Architect.**

joyment. The possibility of such a roof loggia, with hammocks and open fireplace, Fig. 4 (since there is no trace of combustible building material), makes the spot ideal at all but the lowest temperatures; and that it is above the mosquito line is not the least of its charms. Even if it were not, in much infested regions a slight smudge in the convenient fireplace would soon repel the intruders.

The possibility of the roof fireplace (see Figs. 4, 5) is but one of the many opened by the unburnable properties of concrete. These "stunts" with concrete, as one appreciative owner termed them, will be briefly referred to later.

In construction, next to the flat roof, perhaps the most notable variation is the treatment of wall surface. Reinforced concrete is not ashamed of its "smooth smears"; on the contrary, it finds them expressive of the massive and monolithic construction; and the most satisfactory designs for houses have especially emphasized this. The broad expanses can be made of delightful texture: "smooth wash," "pebble dash," "sand-floated" finish and the many variations of "exposed aggregates." And each one of these can be obtained in a color suitable to the neighborhood and the surroundings. A house beautifully placed in the Connecticut valley has as its aggregates and sand ingredients a pinkish gravel, largely composed of rose-colored quartz, from the neighborhood. This concrete, scrubbed down to expose the aggregates, gives the wall a delightful pinkish bloom, which will be further brought out by the contrast of the dull green of the roof. Fig. 3, which is deeply shaded by a grove of magnificent chestnuts, has a much smoother finish of pale gray, which wonderfully lights up its blue-green tile roof. Fig. 6, shaded by elms, is of the same gray, with a darker gray roof of reinforced concrete. I am not myself an advocate of exposing the aggregate completely; it is highly laborious, and, to my thinking, somewhat too vivid and unrestful in effect; yet many find it extremely pleasing. But all these methods of surface treatment are being most enthusiastically and successfully studied, and their technique is pretty well understood. My especial interest is only in pointing out that the variety of effects is so great that the thoughtful architect can always adapt his wall tex-

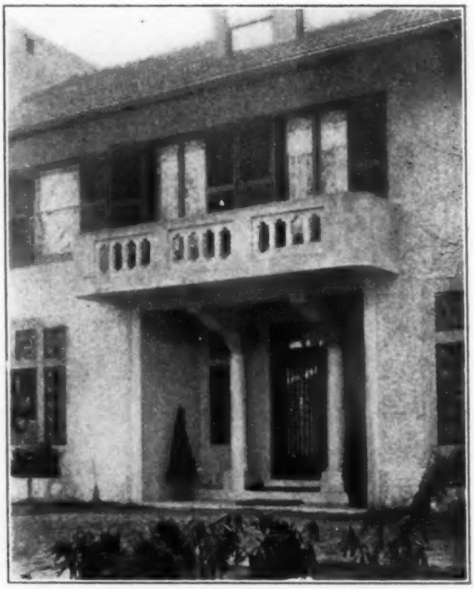


Fig. 8. Loggia on Griggs House.

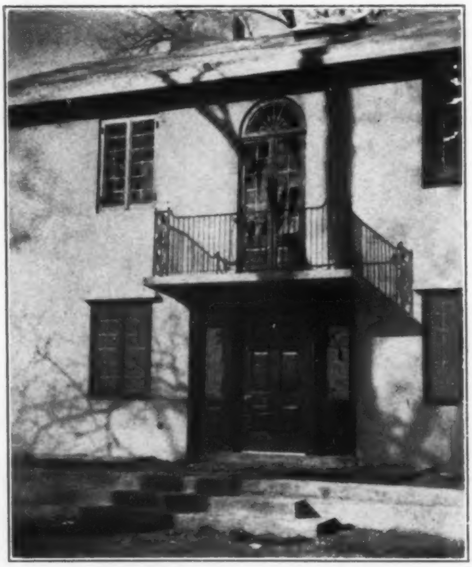


Fig. 7. Balcony on Cochran House.

FIG. 9. NEARER VIEW OF PEARMAIN HOUSE.

FIG. 10. GARAGE OF COCHRAN HOUSE.

ture to the size and purpose of his building, to its background and surroundings.

Apart from the "smooth smears," the question of wall treatment is likely to settle itself for the economical builder. Mouldings, string courses, etc., a natural and easy method of expression for the builder in stone or brick, are, through the great cost of forms, almost prohibited in concrete. Recessed panels have their possibilities, but they, too, present difficulties in the way of sharp edges, not impossible to produce, of course, but costly. The logical source of variations for wall spaces, in the country house, at least, is in the possible contrasts of texture, especially about the windows, as in Fig. 1.

In fact, in the fenestration itself is found the architect's greatest opportu-

FIG. 11. GARAGE AND STABLE WITH LIVING QUARTERS—PEARMAIN HOUSE.

FIG. 12. DESIGN FOR GARAGE—DELANOY HOUSE.

John A. Gurd, Architect.

Fig. 13. Garage Below Kitchen—Griggs House.

nity. The grouping of windows, in contrast to the broad wall spaces (Figs, 2, 3, 9) is seen in the examples to have a very satisfactory effect. Relieving the windows with brick casings or leaded glass is also often successful (Fig. 1).

The question of wall ornament is one that is not often raised in connection with the country house. Of course, there are unlimited possibilities in a concrete structure for insertion of mosaic of various kinds, including mosaic brickwork, or ornament in relief, but their suitability to a country house is problematic. I have been, on the whole, an opponent of the use of mosaic, preferring the use of recessed panels, offsetting columns, etc., but study has convinced me of the very great sanitary value (and especially for cities) of an ornament flush with the wall. Ornament in relief can undoubtedly be executed in concrete to a very great degree of sharpness of edge, complicated and cut-under detail; yet it remains a *tour-de-force*, recalling too vividly that which it is not —cut stone. It would seem that if relief ornament in concrete is to be employed at all, it should rather emphasize those qualities in which it differs from stone, and seek the massive, molded effects, rather than the cut-under ones. And if this is true of applied ornament for house exteriors, how much more so of the various forms of accessory structures? These, however, deserve special discussion. So far as the walls are concerned, the most successful houses up to this time are those in which simplicity and large rounded forms prevail.

The balcony is another striking test of what can be done with concrete on a house exterior (Figs. 7, 8). These balconies are excellent examples of the cantilever in concrete, forming, in Fig. 8, an unsupported porte-cochère, while they illustrate also the previous point as to large rounded forms.

As for the accessories of the country house, the most important is the stable or garage. In many country places of traditional types of construction, the architect, while maintaining admirable sobriety in the house, has let his imagination run riot with the stable. This is regrettable, and if the utilitarian lines of the concrete garage are a step in the opposite direction, so much the better; and to-day no enlightened owner is building his garage, at least, of anything but concrete. With living quarters for chauffeur, and space for several automobiles, such a roomy, but simple, structure can be built on exactly the same lines as the house

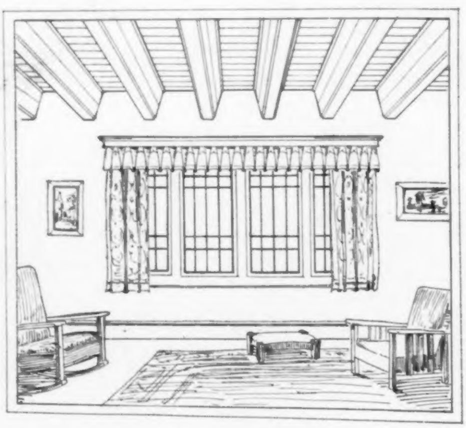


Fig. 14. Sketch of Tapering Beam Construction—Residence of Hinsdale Smith, Esq. South Hadley, Mass.
Kirkham & Parlett, Architects.

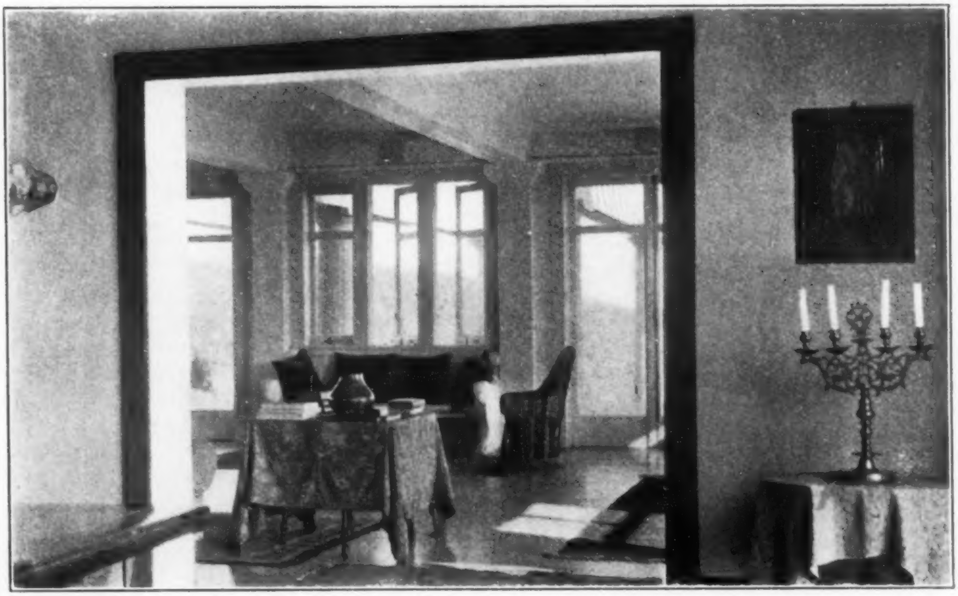
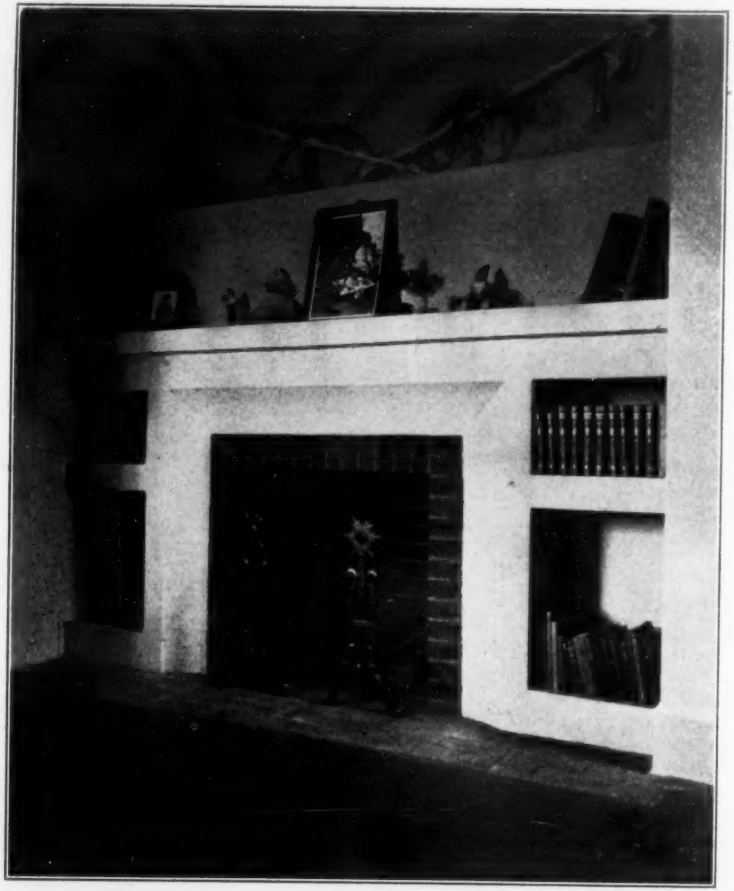
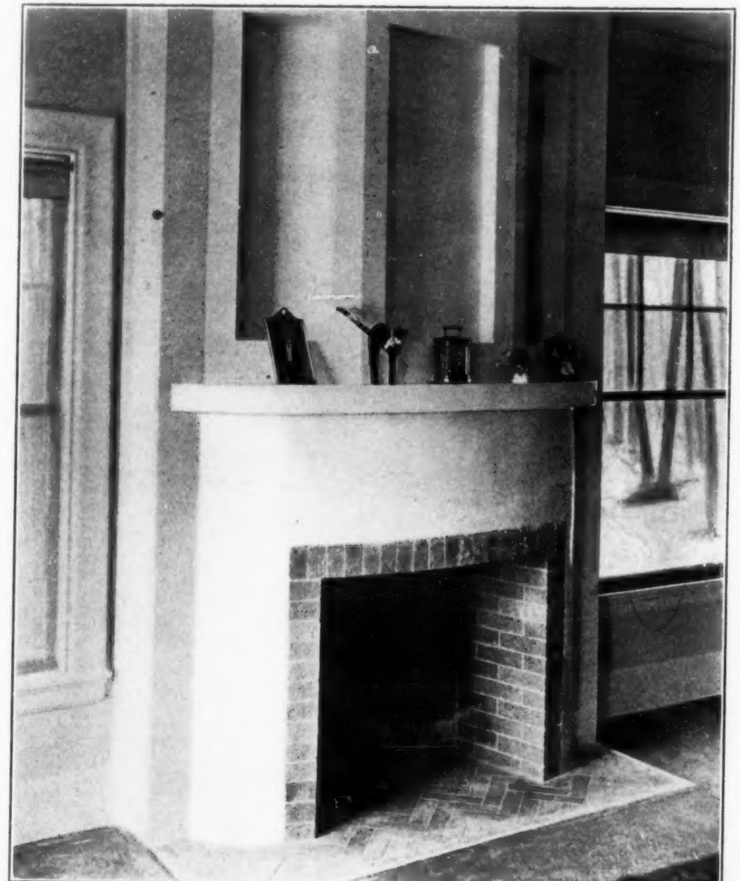


FIG. 15. VIEW OF MUSIC ROOM—PEARMAIN HOUSE.
Note the deep and broad rectangular beams.

FIG. 16. DINING-ROOM—PEARMAIN HOUSE.
Note the deep rectangular beams running parallel to the fireplace.





FIGS. 17, 18. BEDROOM FIREPLACES—DELANOY HOUSE.

(Figs. 10, 11, 12), or even, following an apparently daring, but perfectly safe, example, can be constructed below the house, if the house is also of concrete (Fig. 13).

The same characteristics of concrete can modify the interior construction. It is well known that the possible span of a concrete beam is considerable, and this opens immense possibilities in the way of large rooms, unobstructed by pillars. The depth of beam increases, of course, with the span, eventually encroaching on the necessary height of the room; but this difficulty can be obviated by treating the two floors above the room partitions between them as a box girder if the plan allows. Thus for a school in the engineering design of which I have been interested, a room, of dimensions 50'x60', unbroken by pillars, was desired. For such a room the concrete girders supporting the ceiling would have been 4 feet deep, but utilized as walls for the cubicles above, with the ceiling suspended instead of supported, they disappeared.

So long as all interiors were finished in wood, any effect of arches was highly meretricious and artificial; constructively, not unlike a piece bitten out of a cookey. But with the true reinforced concrete construction, as we have seen, the logical form of beam and lintel is a low arch; and there is, therefore, every reason for such interior openings in an all-concrete house. Thus, those who see a certain Oriental tendency in the development of concrete forms will not be mistaken.

Another architectural feature which took its rise in warehouse construction, and which, so far as I know, has been utilized only in this single example for dwellings, is the tapering beam. This simply does away with the unnecessary concrete at the lower edge of the beam, where its compressive value is *nil,* and is thus in its inception a purely economical device, but I was myself astounded at the effect of lightness and spaciousness in a room so planned (Fig. 14). Contrast these rectangular beam effects (Figs. 15, 16), attractive enough in themselves, with the suggestion of the ceiling shown in Fig. 14.

But it is when we come to the interior finish that the new possibilities are most striking. The first question of the owner, in discussing concrete possibilities, is, "But isn't it terribly hard and unhomelike inside?" No, and no again. First, because, if so desired, the concrete can be concealed, the walls and ceiling plastered, or even papered; wooden trim and brick or marble fireplaces may recall the ordinary house. Secondly, because the real concrete, properly and artistically treated, or combined with cognate materials, makes a warm and delightful interior. A very interesting development of the taste for concrete effects has shown itself in what the owner, watching progress, has demanded.

In my second concrete house, the owner papered the walls and put in hardwood floors. The third was partly plastered, but the owner greatly prefers those rooms which were left in concrete and tinted, although demanding that the boardmarks be obliterated. A later one is finished inside with fine cement blocks in appropriate colors, except on the upper floors, where the concrete is not plastered. The last owner for whom I have worked is captivated by the evidence of construction in the house, as in any hand-made object. In the room where the tapering beams are shown, the forms were so made that the boardmarks on the concrete are retained as a decorative treatment, not even the ceiling being plastered. Here, too, as in the outside walls, innumerable shades and textures in the concrete itself can be obtained. I would strongly advise the prospective owner to visit the permanent exhibit of the Concrete Association of America, in New York, at 225 Fifth Avenue, where the various cement companies demonstrate these possibilities of interior finish.

The same growth of taste in favor of concrete has shown itself in regard to floors. Hardwood, at first; then terrazzo, or tiles were preferred. But concrete floors, with the proper treatment, no longer crack and can be stained any color. One most successful room, with

FIG. 19. FIREPLACE IN MUSIC ROOM—PEARMAIN HOUSE.
Sculpture executed in place by L. O. Laurie.

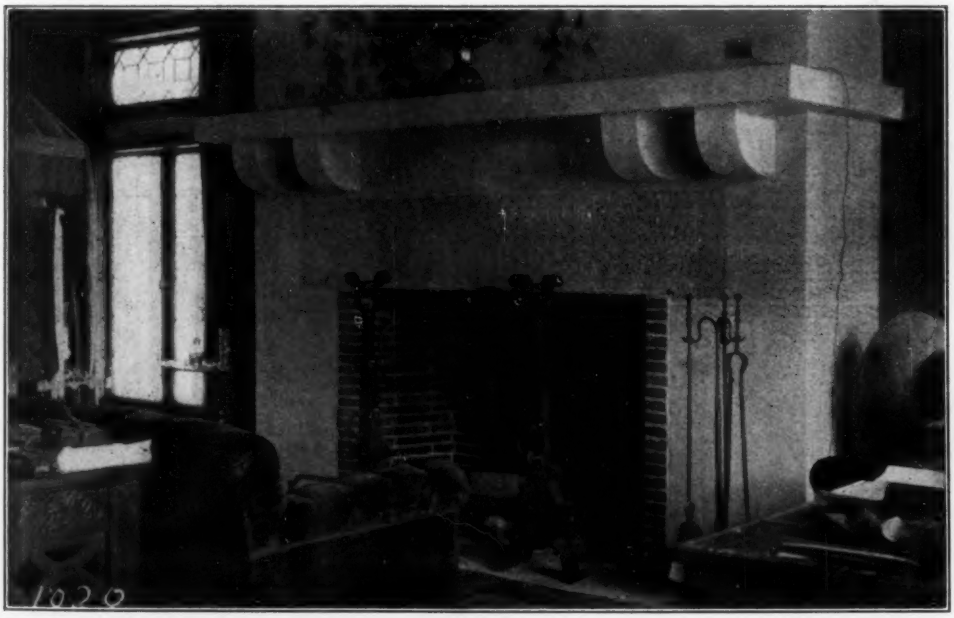


FIG. 20. FIREPLACE IN GRIGGS HOUSE, SHOWING LINTEL OF ROUGH CONCRETE.

a northern exposure, has rough plaster walls tinted a golden yellow, a plain cream-colored concrete fireplace, and a floor of clouded brown and yellow. It is true that this was rather good fortune than intention, since the owner expected a solid brown floor; but if the result is the most wonderful Spanish leather-brown and yellow, who shall cavil? For a drawing or reception room, terrazzo of Siena or Connemara marble chips in quisite bas relief and somewhat less successful caryatides in cement. A fairly typical fireplace is given in Fig. 20. This was designed for smooth finish, and the workmen were preparing to cover up the slab of rough concrete when the owner found them. "Leave that just as it is," he cried; and, indeed, it has turned out the most successful, because the most expressive, firep'ace in the house. For bedrooms, such simple forms, lined with

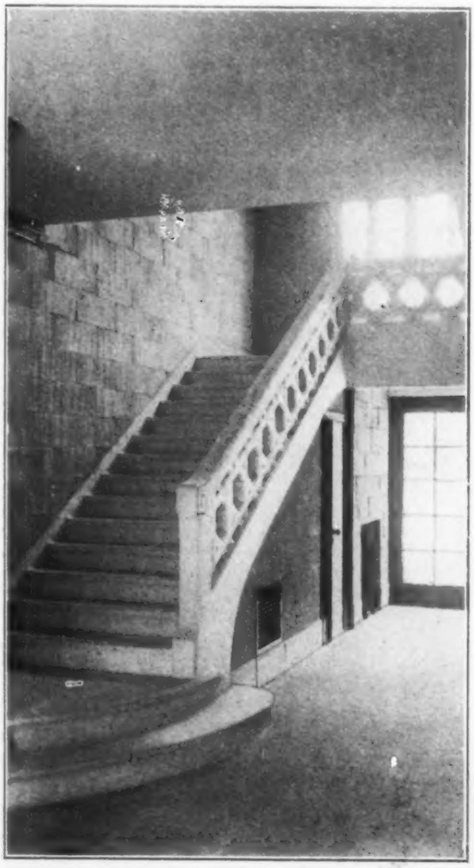


Fig. 21. Main Stairway—Delanoy House.

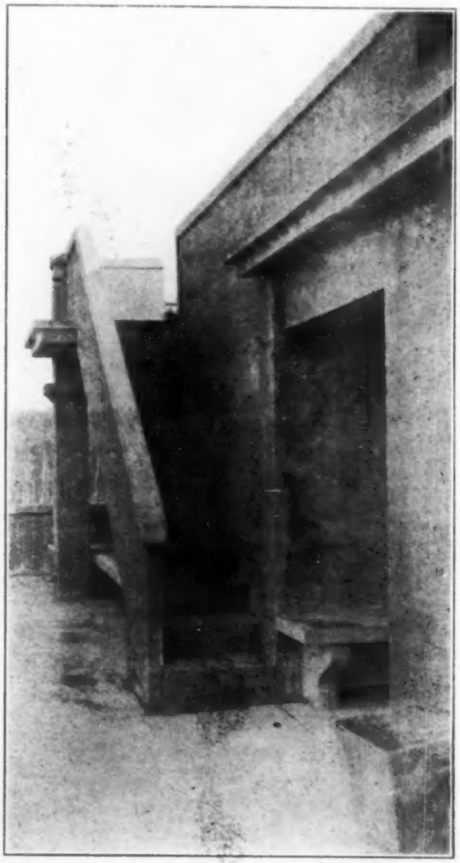


Fig. 22. Roof Stairway, Pearmain House.

white cement, makes a good background for Oriental rugs; and so far from being cold, is almost too warm.

A whole chapter could be written on the new designs in fireplaces; they range from the simple (Figs. 17, 18) to the ornate example (Fig. 19), in which a well-known sculptor has modeled an ex- brick, are pleasing, while the roof fireplace (Fig. 5), in warm gray cement, is, to my mind, the best of all.

Stairways are best made of concrete. This is another "stunt" for concrete, for it can perfectly well be left entirely unsupported. In the ordinary house, however, such a *tour-de-force* would have

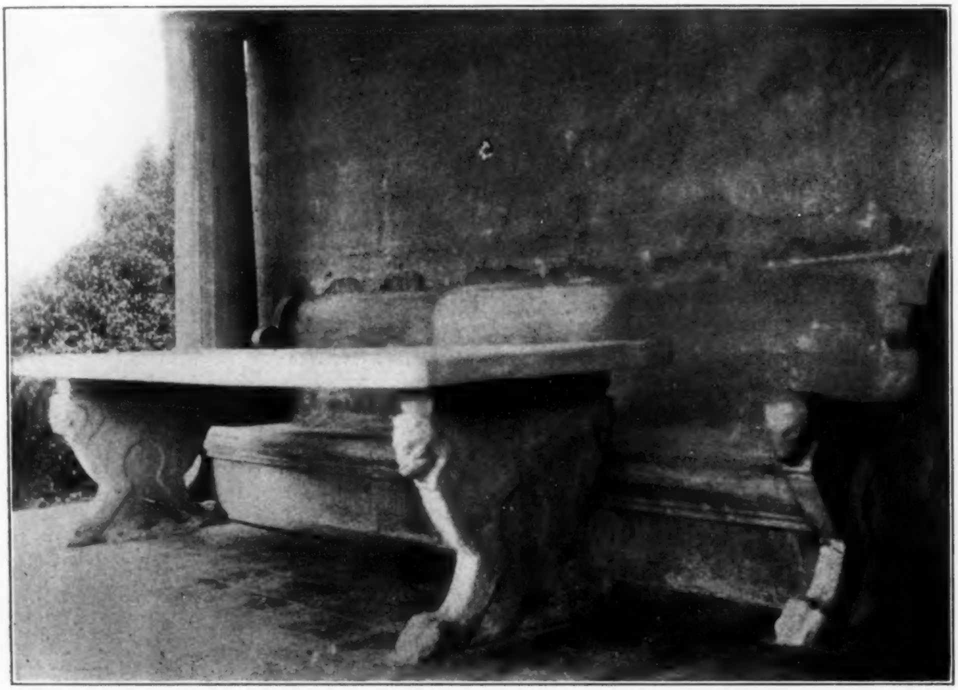


FIG. 23. CONCRETE SEAT AND TABLE—PEARMAIN HOUSE.

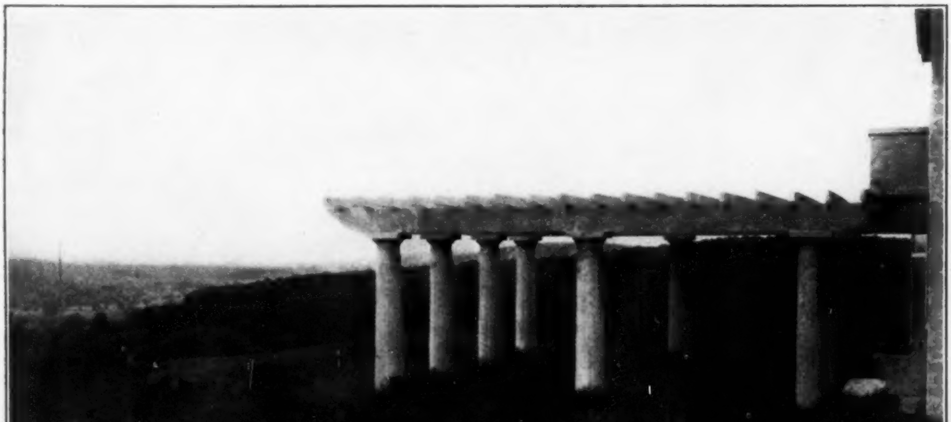


FIG. 24.—CONCRETE PERGOLA—PEARMAIN HOUSE.

little place. The rail is legitimate matter for discussion, since for a house that is not a palace the wrought iron or bronze rail seems unsuited, and the wooden one still less so. The architect of the Delanoy house has designed a successful expression of concrete (Fig. 21), which was intended to be capped by an inconspicuous wooden rail, more pleasing to the hand. The roof stairway (Fig. 22) is decidedly picturesque.

This is not the place to discuss the comparative merits of formal versus natural gardens; but a word may at least be said of the curious effect of an Italian garden, with concrete or marble benches, fountains, statues, etc., surrounding the typical American country house of wood. It suits a reinforced concrete house, however. Exquisite garden furniture may be made of concrete, but here again the most successful are those of molded or plastic, as against sharply cut forms. A charming example is the "Smiling Lion" (Fig. 23), an adaptation of a design from one of Alma Tadema's pictures. An interesting example of how the exigencies of construction can determine pleasing results is given in the columns of the pergola (Fig. 24). The round pillars on one of the first houses I built had to be made, for all that was then known, with a polygonal form, which was afterward plastered up to the round column. Having the opportunity of building a like column for the next owner, his attention was attracted by the pleasing form of the unfinished core, and on that house the columns were left unplastered. The columns of a succeeding house had the same form, but an increased number of sides, the twenty required by the Doric type, resulting in the very pleasing forms found in Fig. 24. It is to be noted that these are not Doric columns. To the rough, creamy gray concrete, the Doric fluting would have been unsuited, and these were made in the easiest and best possible concrete construction; yet the play of light and shade on their flat sides is delightful.

What reinforced concrete means for the safety of families and the permanence of homes need not be insisted on here; but there is a real architectural bearing in the possibility of enshrining precious objects, tapestries, paintings, *objets d'art* generally, in such dwellings. An owner of such treasures who cannot to-day build a fireproof museum of his own is likely to deposit them in public museums; but the unburnable house can safeguard them, and its plan is quite likely, in the more costly examples, at least, to be influenced by the character of its contents, and in the direction typical for concrete. That is the province in which I, as an engineer, feel most keenly the need of the interest and progressive achievement of the architectural profession—characteristic design in reinforced concrete which shall embody the qualities of this noble building material: its monolithic type, its capacity for enormous spans, its economic curves.

Benjamin A. Howes.

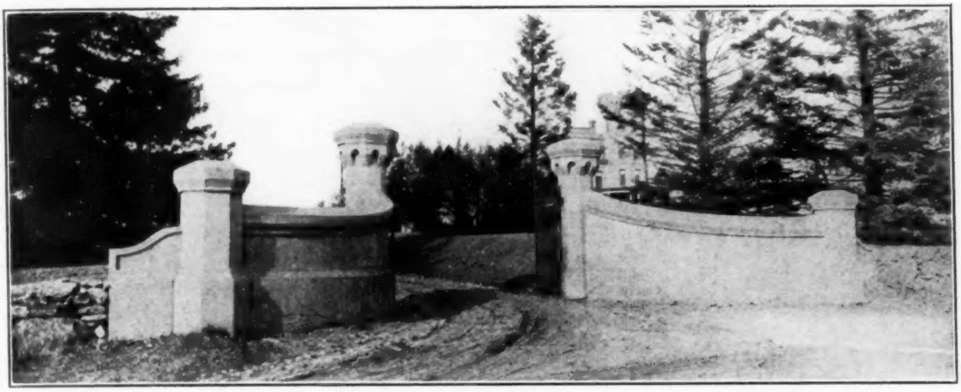


FIG. 1. CONCRETE GATEWAY TO THE ESTATE OF THE HON. WILLIAM L. WARD.
Portchester, N. Y. Robert Mook, Architect.
(Photos by J. H. Symmons.)

The Pioneer Concrete Residence of America

As far as the writer has been able to ascertain, the first concrete building erected for a private residence is the house of Hon. William L. Ward, now Congressman from the Westchester district of New York, located about a mile from Portchester. It was the writer's privilege also to visit it when its shell had been completed and also when it was approaching completion, and to publish a description of it in the American Architect and Building News of April 18, 1877, which was the second year of its publication by Osgood in Boston. For want of photographic illustrations, a detailed description of the design of the house was given at the time, which it is not necessary to repeat now, in view of the fact that photographs of it are herewith reproduced for the first time in any publication.

The house was commenced in 1875 and completed in 1877. Mr. Ward was at that time the manufacturing manager of the screw factory of the Russell, Birdsall & Ward Manufacturing Company, which was located on the Byram River, within view of the house. He has lived in it ever since, and it stands today just as it was built. The architect was Robert Mook, of New York, who had been been brought up in the office of the "fashionable" architects of that day, Thomas & Son. The house is a well-preserved specimen of the Hudson River villa architecture that prevailed at that time, and as the interior views show, the details and furnishings illustrate a harmony of refined design which has evidently come down to us without change through the intervening thirty-three years. So much, however, cannot be said of the exterior. While there are no indications in these interior views (Figs. 3 and 4) that floor, ceiling and side-walls are all of solid concrete, Fig. 2 shows the monolithic character of the exterior, even with all its newness, just as it was built.

Let the reader not be deceived by supposing that anything about it looks as if it had been added to the solid walls built in position, for he is assured by an eye witness that every terrace, porch, bay window, corbelled balcony, cornice, mansard roof, chimney, dormer and matchicolated tower is one solid piece of concrete to the last detail. If this house had been erected within the last few years it would be advertised by promoters as a "poured" house. But it was not built by Mr. Edison, with cast iron moulds weighing perhaps a thousand tons for a house of this size, but by Mr.

Ward himself with pine board accessories, the village carpenter and a lot of unskilled laborers, intelligently directed. To complete the surprise, if any such is suggested, let the reader refer to these interior views and be assured that the ceilings of those two rooms, with all their paneling, except the work of the ornamental plasterer, were all made of structural *reinforced concrete*, forming the support of the second floor, *thirty-four years ago.*

paneled and elaborately ornamented with plaster. The architect designed all the details of inside finish, and they were ultimately carried out with fidelity. But Mr. Ward, who had for some time been studying the uses of Portland cement in Europe and all its possibilities, became his own builder and erected the entire house with his own employees. He was acquainted with the system of Coignet, as used in France; but when it came to building his floors *he proceeded to in-*

FIG. 2. CONCRETE HOUSE OF THE HON. WILLIAM L. WARD.
(Erected 1875-1877.)
Portchester, N. Y. Robert Mook, Architect.

vent reinforced concrete, until convinced to the contrary, as the writer believes. He anticipated Thaddeus Hyatt by two years, for Hyatt's inventions were not made and published until 1877.

As a matter of history, it may well be advisable now to tell how the house was built. Mr. Ward ordered the plans from his architect for a large, first-class, comfortable home, with walls such as would be required if they were of brick with a hollow space, and floors of the usual thickness required for construction with timber, furred off on the underside,

Before Mr. Ward had finished he had used 4,000 barrels of English Portland cement, 8,000 barrels of sharp sand found on his property, 12,000 barrels of

machine-broken North River limestone and an equal amount of white beach pebbles. For construction work, he used as an aggregate broken stone mixed with pebbles, which he found by experiment showed less voids than if either aggregate had been used alone.

But for a better understanding of how the floors were built, quotations had better be made from the account written thirty-two years ago:

"Anyone who visits this house, expecting to find a vaultlike structure, wherein the one idea of a house made in a solid block is predominant, will be disappointed. On the contrary, when he enters he will see hardly enough to convince him of the nature and construction of the building. He will see floors resembling single sheets of rubbed sandstone, hard-finished white walls, flat paneled ceilings, moulded and enriched with moderation, and plaster cornices of good section and very tasteful ornamentation, while all the woodwork he sees or can find in the whole house is the necessary door and window finish in superb hardwood of workmanship that would put to shame some of our best mechanics. Above the basement story there is hardly anything in the interior to remind one of concrete, except the stairways and the kitchen fireplace. Yet there is not a lath or a wooden furring strip in the whole house, for every foot of plastering is laid on the solid concrete of the walls, partitions and ceilings; and the ribs of every ceiling have their constructive purpose, as will presently be seen. The floor construction was thus described:

"This is a combination of light rolled I-beams, small rods and concrete; and though the materials are nearly the same as those employed for floor construction in Paris, the method of using them is different, and the strength obtained results from other principles of construction. In this building the beams are strengthened by being surrounded by a

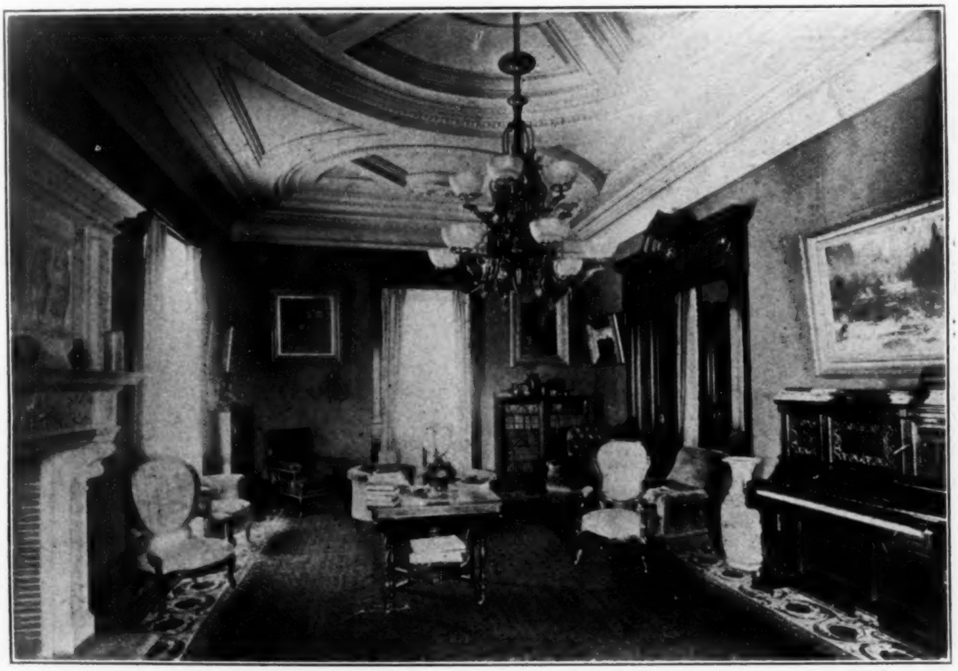


FIG. 3. MUSIC ROOM—CONCRETE HOUSE OF THE HON. WILLIAM L. WARD.
Portchester, N. Y. Robert Mook, Architect.

body of concrete, and the filling between them is a homogeneous mass, extending above the tops of the beams and to all four sides of the rooms. The floors are thus stiffened not only in the direction of the beams, but in all directions. For this purpose a ledge is built out in the walls around each room to carry the outer edge of the concrete floor. The beams being stiffened by a surrounding mass of concrete, are very much smaller than those heretofore used for floors of equal extent. Throughout the house, 'light' five, six and seven-inch I-beams have been used, and for the largest rooms 'light' eight-inch beams. For instance, in the construction of the parlor floor, where no decorative effect is sought in the room beneath, he has used 'light' eight-inch beams, placed six feet between the centers. The span is about eighteen feet. A box is formed around each beam and filled with concrete nearly to the top of the beam. Then a flat centering of rough boards is set between the beams and a coat of cement put on about one inch thick. Then a course of ⅜-inch iron rods is laid on this concrete across the beams and a few inches apart, and another course of concrete, one inch thick, is laid over the rods. The next course of iron rods is then laid, crossing those in the first course. Then concrete is put on, two or more inches in thickness, and the floor is built. It is about four inches thick between the beams. A second flooring is then laid of concrete, leaving arched spaces which are to serve as heating flues, connected with the furnace and the hollow spaces in the walls. On this the finished floor of cement, mixed with sand only, is laid, troweled off smooth, and after a time, when hard and dry, is rubbed with stone and sand like polished sandstone. The rough board centering and boxes around the beams being removed, the under surface is ready for a coat of brown mortar, which is hard finished in the usual way."

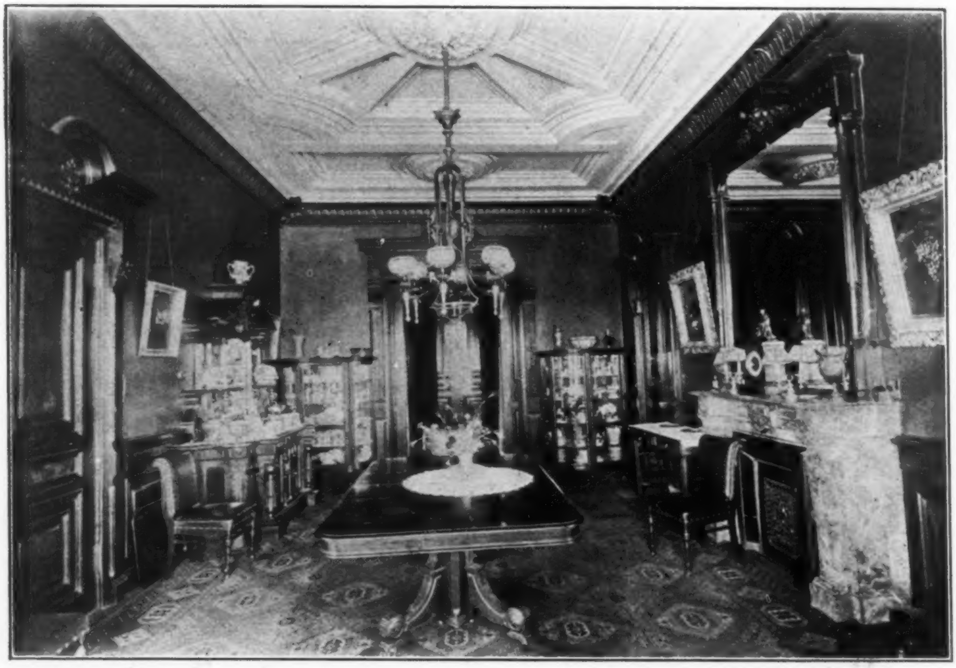


FIG. 4. DINING ROOM—CONCRETE HOUSE OF THE HON. WILLIAM L. WARD.
Portchester, N. Y. Robert Mook, Architect.

It will be noted from the above that

the actual floor construction between the beams, which are six feet apart for the first floor, is only four inches thick, and that one-half of the reinforcing rods are set in the same direction as the beams. The thickness of the floor adds to the height of the beams where they are in compression, just as in the reinforced concrete T-beams that have recently been experimented upon. The concrete heating flues and the finished cement floor are in one sense part of the floor loads; but, at the same time, they may have assisted to stiffen the floors. All the floors are covered with rugs made to fit the rooms, held in place by brass pins inserted in sockets built into the cement floors.

"The ceilings of the first and second stories show deeply recessed panels, some quite elaborate in construction, as in his Elizabethan library on the second floor. In constructing these, I-beams were used, following the ribs and bolted together so as to form a complete network over each room. Yet such light sizes of iron were used that in most cases it could hardly have been more than self-supporting. In some rooms not more than two beams extended from wall to wall. Boxes were constructed around all of the parts of this framework, as in the first story, and filled with concrete, thoroughly rammed in place and given good time to set. The interstices were filled with concrete and iron rods, as in the first floor. All these ceilings are plastered and ornamented directly on the concrete. The mansard roofs are constructed of solid concrete; the ceiling over the third story the same as the other floors. The roof is constructed like the floors, the beams being very far apart, fully ten feet in some places. Over each beam and hip rafter in the roof a shrinkage joint is made, and this is covered with a moulded hip roll, made in position, but having felt between the roof and the roll. The panels of the roof, between the hip rolls, are decorated on the outside with *scraffito* work in cement of different colors. The cornice and main gutters are all made with the walls, but there are shrinkage joints between the roof and walls. There are also shrinkage joints in the rooms following the inside lines of the exterior walls, where they cross the window recesses. Aside from these joints, the floor of each room is in a single piece; and not a crack was observed in the floors through the entire house."

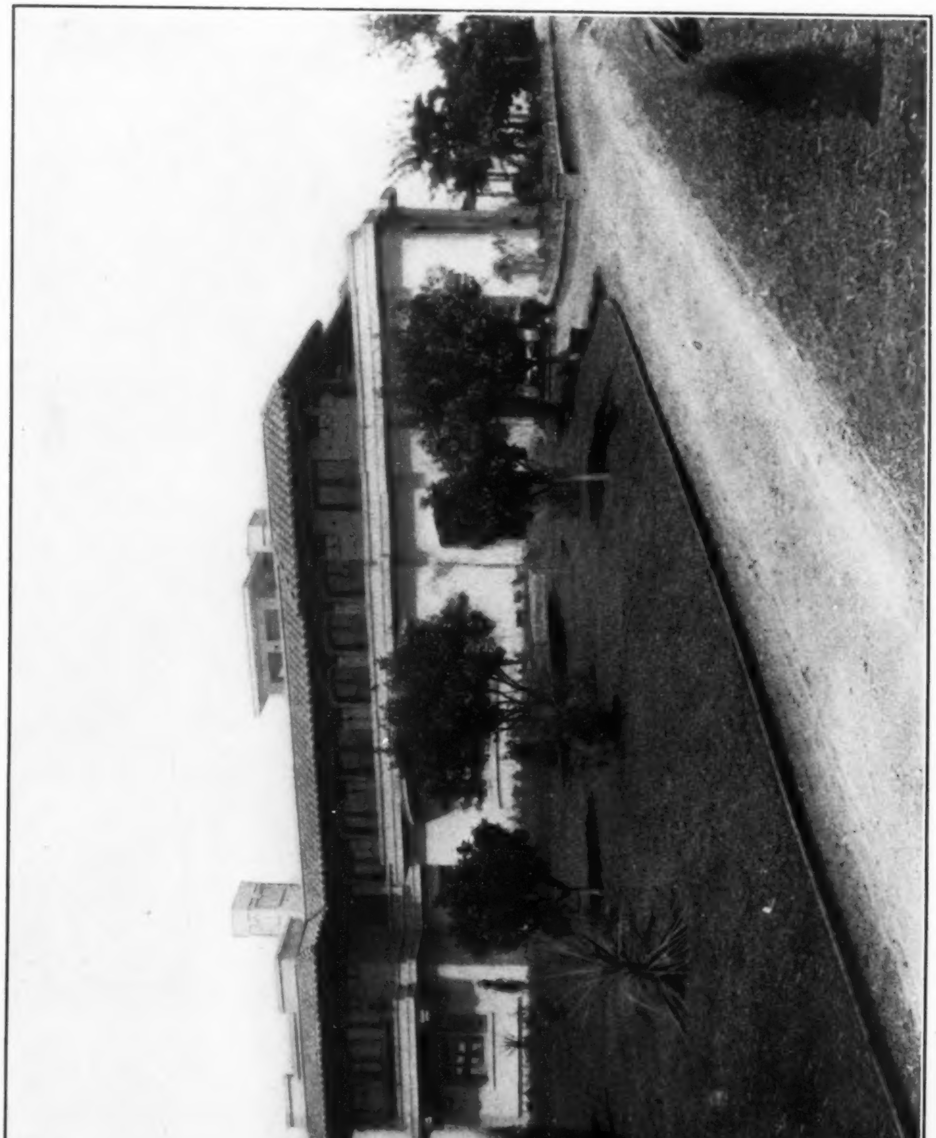
The slabs forming the floors and roofs of the terraces in some places are in pieces 12 by 30 feet, without shrinkage joints, all being reinforced with 3/8-inch rods in both directions.

The smoothness and uniform color of the exterior walls is due to the fact that they are all plastered with a 1-to-2 mixture of Portland cement and sand. This plastering, after it had set and been thoroughly dried, was rubbed down with a stone, sand and water, just as sandstone is polished. The exterior mouldings were finished in the same way. The veranda columns were all reinforced with vertical rods of 3/8-inch iron, placed in a circle within a proper form, and the cement was poured from the top. But they were made with hollow spaces in the center, and served also as downspouts to carry off the water from the veranda roofs.

The roof water is carried down in cast iron pipes built in the walls, and brought together in the cellar, where they connect with the rising pipe to the rain-water tank in the square tower shown on Fig. 2, forming a syphon. Water can thus be drawn under pressure from these pipes. There are two water tanks in the tower, one over the other. The lower one is used for rain water and the upper one for water pumped from a spring. The floors of these tanks are of reinforced concrete, and the tower walls form their sides.

The exterior walls are cast with hollow spaces. These are connected with the spaces in the concrete under the floors, so that there is a circulation of warm air through all the walls and floors heated by a furnace. The air is returned to the bottom of the furnace, and does not enter the rooms. All rooms have open fireplaces.

Peter B. Wight.



Los Angeles, Cal. FIG. 1. MR. G. E BERGSTROM'S RESIDENCE. Parkinson & Bergstrom, Architects.

Some Fire-Resisting Country Houses.

I.—HOUSES OF BURNED CLAY CONSTRUCTION.

It is not many years since the just claim was made by writers on contemporaneous architecture—and the same had been admitted by foreign writers—that the typical architecture of the United States was best exemplified in its country residences. At that time it was believed that we had best solved the problem of designing in wood, for the best designs were in that material. They blended so well with their natural surroundings that we looked upon them with the satisfaction that we, at least, had accomplished one success—even though it were in buildings of comparatively minor importance—in the development of a national architecture.

Meanwhile, though the same could not be said as to our success in designing urban residences, their construction had been developed to a high degree of excellence, and many of the more pretentious ones had been built in accordance with the systems of fireproof interior construction that had been so highly developed in our public buildings, banks, office buildings, hotels and structures for business purposes. The owner of the city mansion was content to erect his so-called "cottage," no matter how expensive it might be, with a wooden frame and with no regard to protection from fire. There were, of course, individual exceptions, and in some places, notably at Newport, may be seen palatial summer homes of very different materials side by side, some of the flimsiest wood construction throughout, some with brick or stone exterior walls and combustible wood interiors, and a few embodying the latest developed methods of fireproof construction throughout.

The erection of country houses with fire-resisting construction has been comparatively rare, and when these exceptions are seen they are found to be buildings of the most pretentious and elaborate sort, only possible to the very rich. It was necessary that some event should call the attention of owners to the risk they ran in exposing their most cherished possessions, stored in country houses, to the danger of destruction from fire, before the necessity for improved construction should be felt. Many of our wealthy citizens have of late years chosen to make their principal residence on their country estates, and there they have installed their books, pictures, other works of art and household treasures most dear to their hearts, in houses replete with all that artistic finish and decoration could supply. But the destruction by fire of the country house of John Wanamaker, in Pennsylvania, and the Chi Psi house at Cornell University, with not only art treasures, but what is more important, human lives, furnished the impetus, only a few years ago, for that evolution in rural architecture of which we are now beginning to see the results. This is not only affecting the construction, but the design, of such buildings. The evidences of the latter are not yet such as to indicate what these results may be. All of the recently constructed country houses in which attempts have been made to build in a fire-resisting manner show only individual characteristics in this respect. In some little attempt has been made to produce good designs. In others there is an indication of the development of novel features, growing out of the nature of the materials used.

The illustrations here produced are mostly of buildings of moderate cost, and it cannot be said of them that the purpose was to avoid the peculiar losses incident to such a house as Mr. Wanamaker built to contain his most valued treasures. But when once attention was called to the impossibility of extinguishing fire in an isolated country residence, when the ample resources of a city fire-fighting force could not be availed of, many people realized that houses of much less pretension and value are equally exposed to total destruction unless the owner furnishes his own preventive expedients, rather than

rely upon imperfect methods of extinguishment.

As a result of this thoughtful tendency of the public mind, a few examples can now be pointed to showing that the situation has been intelligently grasped by a few people with more than ordinary foresight.

The examples to be illustrated and described show that such fire-resisting country and suburban houses as have thus far been erected may be divided into two classes: those following the burned-clay systems and those build according to the concrete systems, while in a few that might be cited the two are combined.

The first illustration is the house of an architect, built for his own use. It was erected in 1907 for Mr. G. E. Bergstrom, of Parkinson & Bergstrom, architects, at the corner of Vermont Avenue and Clinton Street, Los Angeles, California, which is essentially a suburban location, as the illustration (Fig. 1) will show. Fig. 2 shows the house just commenced, Fig. 3 constructional section drawings, and Fig. 4 the floor construction system. The exterior walls are built of doubled 6-inch and doubled 4-inch hollow tiles, the partitions with 4-inch hollow tiles, and the floors and roof are constructed according to the Johnson tension system, 4-inch tiles being generally used. The foundations are of concrete, and reinforced concrete is used for interior girders and exterior lintels. The spans of floors and roof are from 16 to 20 feet. The chimneys, balustrades and flower stands are built of hollow tiles. The visible part of the roof is covered with Mission tile. No steel is used, except as a tension material for the floors, the concrete girders and concrete lintels.

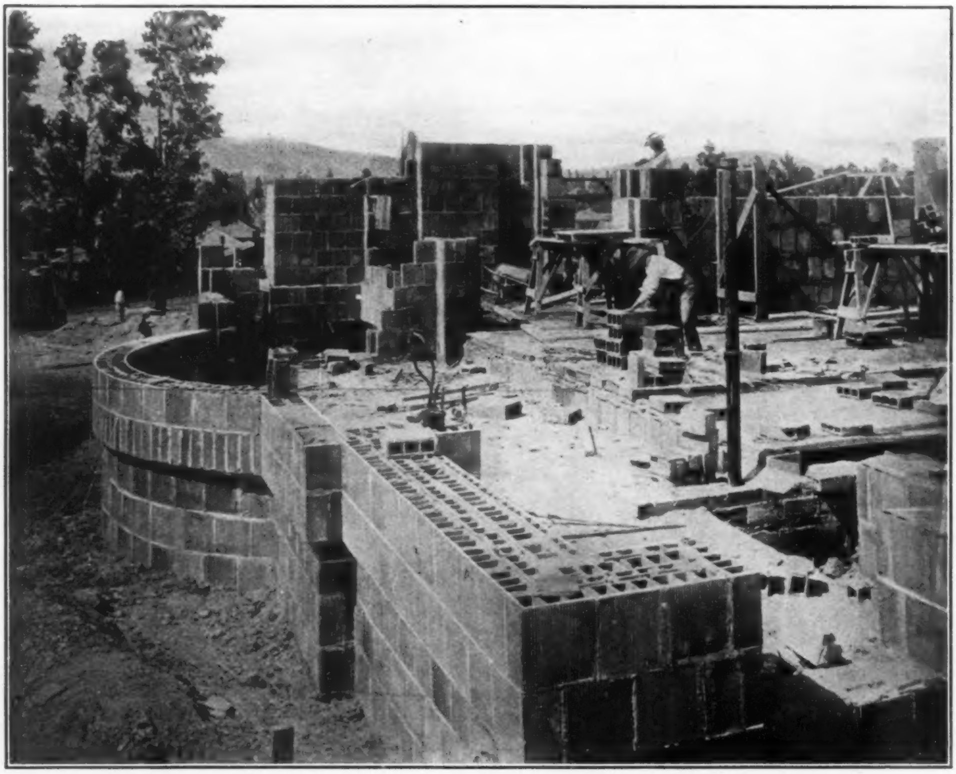


FIG. 2. RESIDENCE OF MR. G. E. BERGSTROM DURING CONSTRUCTION.

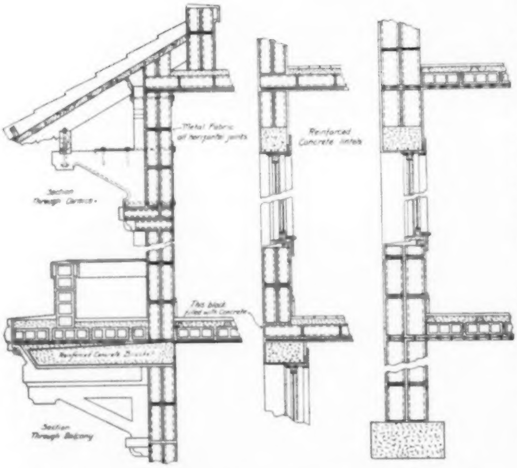


Fig. 3. Constructional Details of Mr. Bergstrom's Residence at Los Angeles, Cal.

These comprise all the materials used for construction. The exterior is coated with a cement and fine gravel mixture, and treated with acid to remove the cement from the exposed surface and leave the gravel visible. The total cost was about $20,000.

As an illustration of what a well-informed architect does when he invests his own money, for his own use, this building forcibly illustrates the tendency of independent opinion on the part of some of the architects of the Pacific coast. As an example of original design, it is worthy of serious attention, for it shows the adaptation of design to material rather than the use of a vernacular style or an attempt to repeat the popular so-called Mission architecture which is so much in vogue in that locality.

For comparison with the last design, the house erected about the same time by Matthew Sullivan, of the firm of Maginnis, Walsh & Sullivan, architects, at Canton, Mass., also for his own use, is shown in two illustrations. Fig. 5 shows one side of the house during construction, and Fig. 6 shows the other side after completion. This house is built of hollow tile, covered with stucco on the outside. But the floors and roof are not fireproof, being of wood. The tile were specially made for it of a form designed by the owner.

The house shown in Fig. 7 was erected about ten years ago from the designs of Charles Henry & Son, architects, of Akron, Ohio. It was one of the earliest houses built throughout with hollow tile, and was erected for the late Henry B. Camp at Akron. Mr. Camp was one of the earliest manufacturers of all kinds of hollow-burned clay products, and had erected many plain houses and barns in his part of the State of Ohio in previous years, with sections of burned clay flue linings. His experience led to the manufacture of special sections of hollow tile for building purposes, the use of which is shown in his own house. The tile used for it were not plastered or painted on the exterior, but were all made with great perfection by machinery. That is, they were forced through dies on a vertical steam press, the same that is used for the manufacture of sewer pipe. The plain wall tile here seen are of fireclay. Those of a darker color are salt glazed. The building is as fireproof as hollow tile can make it, all the partitions being of the same material, and the floors are built on the tension principle spanning the full width of the rooms, as shown in Fig. 4. It will be noticed that the porch and its balustrade are built of the same material as the walls.

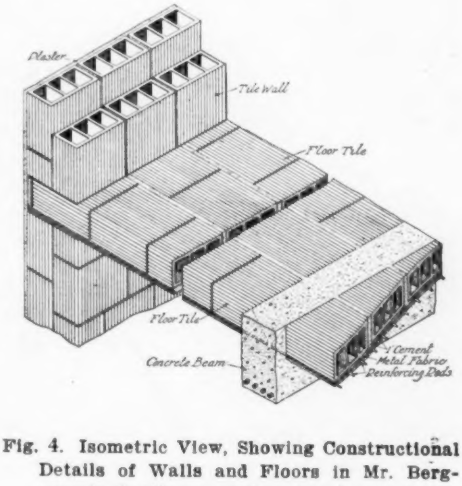


Fig. 4. Isometric View, Showing Constructional Details of Walls and Floors in Mr. Bergstrom's Residence at Los Angeles, Cal.

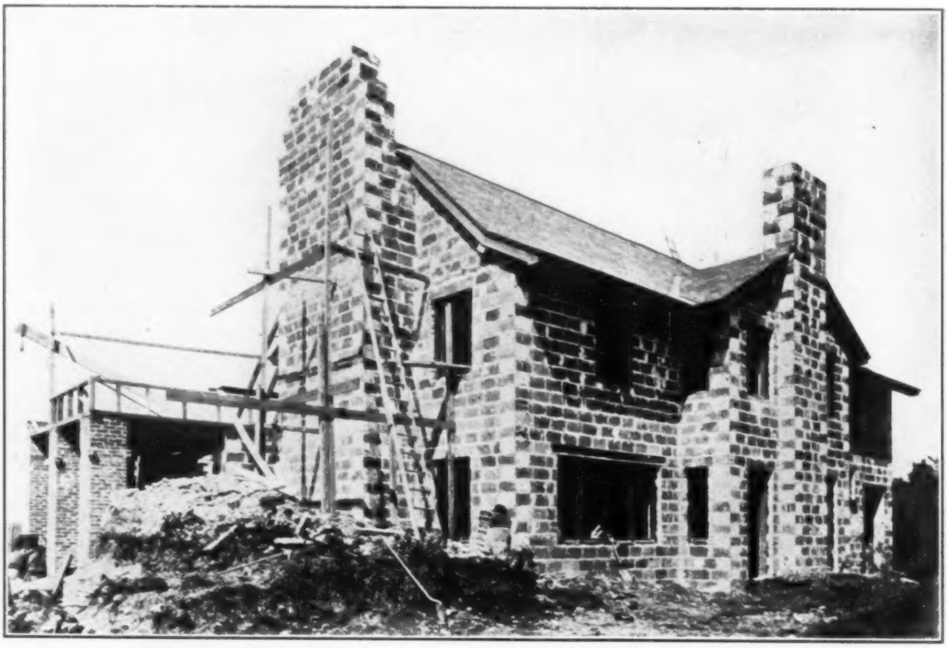


FIG. 5. HOUSE OF MR. MATTHEW SULLIVAN DURING CONSTRUCTION.
Canton, Mass. Maginnis, Walsh & Sullivan, Architects.

FIG. 6. OPPOSITE SIDE OF MR. MATTHEW SULLIVAN'S HOUSE TO THAT SHOWN IN FIG. 5.
The house in this view is shown completed.

FIG. 7. HOUSE OF THE LATE HENRY B. CAMP.
Akron, Ohio. Charles Henry & Son, Architects.

FIG. 8. RESIDENCE OF MR. CHARLES W. CLINTON.
Tuxedo Park, N. Y. Clinton & Russell, Architects.

FIG. 9. RESIDENCE OF MR. WILLIAM BORLAND.

Mount Kisco, N. Y. Delano & Aldrich, Architects.

FIG. 10. THE SUMNER RESIDENCE.

Englewood, N. J. Delano & Aldrich, Architects.

II.—FIRE-RESISTING HOUSES OF CONCRETE CONSTRUCTION.

The adaptation of improved systems of reinforced concrete construction to country architecture has been comparatively recent, notwithstanding the example set by William L. Ward at Portchester, New York, as long ago as 1875. Such houses as have been recently erected with this material have rather been an evolution from the methods that have been employed in factory construction within the last few years, than from that used in the Ward house. Yet the basic principle involved is the same in both.

The examples illustrated herewith are on the Pabst Farm, at Oconomowoc, Wisconsin, which have been recently completed. Mr. Frederick Pabst, of Milwaukee, grandson of Philip Best, one of the pioneer brewers of Milwaukee, purchased one thousand acres, or thereabouts, of land and lake, and on it has installed a breeding and stock farm. No less than thirty buildings were required for its complete installation, including a summer residence for the owner. All the others are accessory thereto, and are disposed in groups according to a general plan. All the buildings were designed by Fernekes & Cramer, architects, of Milwaukee, and are built wherever possible of concrete, with no attempt to conceal its nature and construction. Four of them are now sufficiently completed to illustrate the general effect of the group. The system of construction used is uniform throughout. They are practically monolithic. No attempt has been made to imitate stone. The floors are either made in single reinforced slabs, with reinforced beams and slabs where increased spans cal'ed for them, and in some instances with girders, beams and slabs. Hollow burned clay tile have been used only for partitions and for the furring of exterior walls. The latter expedient was for the double purpose of securing dryness and protecting the interior surface of the concrete walls in case of interior fires. The houses are sufficiently isolated to avoid the contingency of exterior fires.

Those illustrated are the summer residence of Mr. Pabst, the residence of the superintendent of the farm, that of the stock superintendent and the private garage which is attached to the residence of the house gardner. As one walks over the farm he discovers groups of buildings which at a little distance might be taken for survivals of the fourteenth century architecture of England, but which, at nearer view, betray their newness and want of clinging vines and surroundings that make their progenitors so charming to our modern eyes. The simplicity of the design fits well upon the novel material used. This is enhanced in the interiors where its massiveness and substantiality are evident. The large rooms in Mr. Pabst's house, which is one hundred and sixteen feet long in its greatest dimension, required very large concrete beams to span them. These are plastered and finished with simple mouldings which do not detract from the massive effect. The walls between the ends of the beams are treated with a simple relief ornament in cast cement. In cases where ornament was thought desirable on the exterior it is also in cast cement of very simple design. Mr. Pabst's house is roofed with red clay shingle tile, and the others are covered with asbestos shingle tile. These are all set in cement on cast concrete blocks, set between light I-beams, which form the roof construction in all the houses. This is the only steel entering into the construction of the residence buildings except the reinforcement used in the beams and floor slabs.

An account of fireproof country houses in the vicinity of Chicago would not be complete without mention of the two important residences now being erected near Lake Forest, Illinois. One is for Mr. J. Ogden Armour, after plans drawn by Arthur Heun, and the other for Mr. Harold McCormick, and designed by Charles A. Platt. Neither of them is yet in condition to be photographed, and both will be the subjects for more extended treatment when completed. They will embody the systems of fireproofing best adapted to their plan and design.

Peter B. Wight.

FIG. 11. ENTRANCE SIDE—RESIDENCE OF MR. FREDERICK PABST ON THE PABST FARM.

Oconomowoc, Wis. Fernekes & Cramer, Architects.

FIG. 12. ANOTHER VIEW OF MR. FREDERICK PABST'S RESIDENCE.

FIG. 13. RESIDENCE OF THE FARM MANAGER ON THE PABST FARM, AS IT APPEARED WINTER BEFORE LAST.

Oconomowoc, Wis. Fernekes & Cramer, Architects.

FIG. 14. THE SAME HOUSE SHOWN IN FIG. 15, AS IT APPEARED AFTER COMPLETION LAST SUMMER.

FIG. 15. RESIDENCE OF ASSISTANT MANAGER ON THE PABST FARM IN WINTER.
Oconomowoc, Wis. Fernekes & Cramer, Architects.

FIG. 16. GARDENER'S HOUSE AND GARAGE ON THE PABST FARM.
Oconomowoc, Wis. Fernekes & Cramer, Architects.

NOTES & COMMENTS

MODERN FIREPROOFING SYSTEMS

In 1881 what we now call modern systems of fireproofing began to come into general use, and were soon developed to a degree that has since known little improvement. The history of the art before that time has often been written. The theory that incombustible building materials alone were needed to make a building fireproof was exploded in 1871, after the Chicago fire. Fireproofing was made the subject of discussion at a convention of the American Institute of Architects in Boston some days after that conflagration; what was said was confined to the destructive effects of fire on iron, and the uselessness of any kind of stone in conflagrations. The discussion was kept up for ten years in various journals in a one-sided way, for no one appeared as the champion of iron as a fire-resisting material, notwithstanding the large interests involved. Yet incombustible buildings continued to be erected. Before 1855 many government buildings had been erected with vaulted brick floors, carried by brick and granite piers. It was the Roman system which had been practiced since the Neo-classic revival in the latter part of the 18th century. In that year (1855) rolled iron I-beams were first used in this country, and the floors built between them with segment brick arches, and later with corrugated iron segment arches covered with concrete. There were others, but these were the usual methods. During that time many genuine and praiseworthy attempts were made by American architects to erect incombustible buildings, supposing them to be fireproof. Some of these buildings still standing have no wood in their inside finish except the floors, the window frames and sashes being of cast iron and the partitions of iron studs, faced on both sides with corrugated iron inclave lathing covered with plaster.

Similar methods continued to be used during the transition period from 1871 to 1881. But it was during this period also that experimental work of another kind was done in scattered instances, both in the East and the Middle West.

EARLY ATTEMPTS AT FIREPROOFING

In New York, Philadelphia and Baltimore this plastic system of making incombustible and protecting iron from the effects of fire with a composition of plaster paris and an imported French cement called Lime-of-Tiel, was introduced by the Fireproof Building Company of New York. The hollow blocks used were according to the system invented by Garcin in 1867. They were the first flat arch floor construction used in this country. All blocks were hollow. The architect Peterson, used hand-made hollow tiles in the first floor of the Cooper Institute, New York, in 1856. They were in one piece, flat on the bottom and arched on the top. The late George H. Johnson invented a similar floor construction made in the same form in several pieces to make a flat arch, which was used in the corridors of the New York Post-office about 1872. The Fireproof Building Company used similar flat arches of burned clay in the halls of the Coal and Iron Exchange, New York, now destroyed, built from plans of Richard M. Hunt about 1876. Later, Mr. Hunt specified the same for the floors of the Tribune Building. In 1872 George H. Johnson built the whole interior of the office building in the burned district of Chicago, called "The Equitable Building," with hard-burned hollow clay blocks, and later did the same for a building of the Singer Sewing Machine Company at St. Louis. In 1875 and 1876 Thaddeus Hyatt, an American, made his extensive experiments with reinforced concrete in England. They were probably the most exhaustive tests ever made of this material for construction purposes. They were published in book form for private circulation in 1877. Nothing of consequence has been discovered since that time bearing on the practicable use of reinforced concrete for building purposes, except the details of constructive systems, and their application to new purposes. In 1876 William L. Ward, of Portchester, New York, built the first complete building of reinforced concrete ever erected in this country. Walls, floors, roof, partitions, porches are of reinforced concrete, and in fact the entire

house, which is a large one and finished in a costly manner, as became a man of wealth building for his own use. It was many years before anyone else determined to duplicate Mr. Ward's work (see page 359).

In 1875 the first cast-iron columns fireproofed with burned clay (there are only two of them) were used in the Chicago Club, now the DeJonge Restaurant. They were covered with porous terra cotta blocks burned with a small vertical hole in each and fastened to the column with screws. The outside finish is plaster, decorated in oil colors, and the capitals are of ornamental terra cotta set around the fireproofing. In 1878 the floor arches of the Cook County Court House at Chicago were built with flat, hollow tiles of rather crude form, and the thin partitions were built of brick in which tan bark had been burned out to make them porous. The Chicago City Hall, built a few years later, 1880, occupying the other half of a city block, was the first large public building of which the entire interior was constructed with hard burned hollow tile, including hollow tile fireproofing for all columns and girders, and a hollow brick tile roof. The last two buildings have been taken down. In 1879 parts of the Chamber of Commerce at Milwaukee were fireproofed with porous terra cotta. The structure was built with cast-iron columns, wooden floor joists and iron roof trusses. In this building the cast-iron columns were covered with solid blocks of porous terra cotta screwed to the iron, and the ceilings were covered with porous terra cotta tiles two inches thick screwed to the floor joists. The most interesting work done on it, which had never before been attempted, was the fireproofing of the individual members of the roof trusses with porous terra cotta.

In 1879, a Mr. Ferry, of Detroit, Mich., appreciating the frailty of cast-iron columns in the case of fire, ordered all the interior columns in a store which he built in that year for Newcomb, Endicott & Co. at Detroit, completely fireproofed with porous terra cotta. There were more than 500 of these fireproofed columns, though in no other respect was the building fireproof. The same thing was done by the late Amos Grannis, at Chicago, a few years later, when he built the Grannis office building, for all the columns in it were fireproofed also with porous terra cotta, screwed to the iron. These are instances quoted to show that at that time investors were alive to the danger of iron columns from collapse in a fire. The Grannis Building was in no other respect fireproof. A few years after the whole interior was burned out, and D. H. Burnham, whose office was located in it, had a narrow escape. When the interior collapsed all the columns above the first story fell into the wreckage, but when they were pulled out, all the fireproofing was still attached to them and uninjured. This was a remarkable test of their fireproof qualities, though they had nothing to do with retarding the flames. They saved themselves, though they did not save the building. It is an experience worth recalling now, because in recent years, when there have been conflagrations in which poorly fireproofed columns covered only with hard hollow burned tile have failed of their purpose and been condemned by the critics of burned clay fireproofing, the experience of the Grannis Block and several other buildings, which might be mentioned, in which the columns have been similarly protected and subjected to severe fire, does not seem to have been of any profit to more recent constructors of fireproof work in buildings.

PRESENT CONDITIONS OF THE ART OF FIREPROOFING

Chicago, whose inventions have contributed perhaps more than any other locality to the improvement of building construction throughout our country, has been prominently mentioned by various writers as one of the advance posts against the demon of conflagration. This is true to a certain extent. Fireproofing devices commenced to be put into extensive use in 1881, and the number of buildings fireproofed in the following ing years up to the money panic in 1893, has been such as to make it impracticable in the limits of this note to name more than those in which some new features were introduced.

The first office building fireproofed throughout in the modern manner was the Montauk at Chicago, erected in 1881-2, remarkable also as having been the first in which concrete and iron grill foundations were used. With the exception of the fact that tiles were not inserted under the ordinary iron beams (a method that was first used in 1884) it was probably as thoroughly fireproofed as any building that has since been erected. In fact it was once attacked by and resisted an exceptionally severe fire on its most exposed side where there were many windows. This building was taken down two years ago to furnish part of the site for the First National Bank Building. The Montauk Block was of brick with some terra cotta details on the exterior and was partially subdivided by brick partition walls,

and provided with brick vaults in stacks. The subsidiary partitions were of hard-burned hollow tile three and a half inches in thickness. The cast-iron columns were covered with blocks of hand made porous terra cotta three inches thick, fastened with machine screws tapped into the iron. The girders were covered with porous terra cotta, in no place less than two inches thick over the most projecting parts. The flat floor and roof arches were made of hollow tiles of high grade fireclay. The bottoms of the beams were covered with three quarters of an inch of cement held between the heels of the skew-backs and covered additionally with the regular plastering of the ceilings. This system of fireproofing was used in many other large buildings subsequently, until the cheap methods of using hollow hard burned tiles for columns and girders came into use.

Meanwhile hard-burned hollow and porous hollow blocks were extensively used in New York and Eastern cities, hollow porous blocks being generally used for partitions and hard tile for flat floor arches. The main difference between the materials used at the East and the West was that the Eastern fireproofing was made of a low grade of fire clay on horizontal presses, and that of the West, in Ohio, and Illinois, was made of a high grade of fire clay on vertical steam cylinder sewer pipe presses.

In 1883 and 1884 the first middle west hollow tile, made in Ohio, was used in New York City, in what is now the Nassau Street Building, the first section that was built, of the Mutual Life Insurance Company's Building. This material was used for the floor arches and partitions. The cast-iron columns and girders were everywhere fire-proofed with solid porous terra cotta blocks on the same principle as that employed in the Montauk Block. A great many shapes and sizes were used. In some cases round cast-iron columns were changed by these blocks to square ones and in others square cast-iron sections were changed to circular ones in the fireproofing, to carry out the architect's design. Some columns were very large, as in the main office. All of this porous terra cotta was machine-made, that is, passed out through dies, and not cast in plaster moulds as had been the method used for the Montauk block.

The interesting feature in the fireproofing of the Mutual Life Insurance Building was that it was the first building ever constructed in which the bottoms of the iron beams were protected from fire by burned clay tiles. They had not been specified but the contractor having perfected a method for holding the soffit tiles securely in place, used them throughout the building. The soffit tiles not only covered the bottoms of the beams, but also the edges of the lower flanges and were of such section that they not only received the full thrust of the abutting flat arches on both sides, but were self-supporting as soon as the cement had set.

THE MANUFACTURE OF CLAY FIRE-RESISTING MATERIALS

From 1884 to the present very little improvement has been made in the manufacture of fire-resisting materials of burned clay. After the use of soffit tile in the Mutual Life Bldg., at New York, the next building in which they appeared was the Stillman Apartments in Cleveland. There, however, the soffit tile were made only as wide as the bottoms of the I-beams and their thickness which was not more than three-quarters of an inch, which was all that received the support of the abutting skewbacks of the flat arches. Both sections of soffit tile have been used indifferently from that day to this. Occasionally architects have specified that the soffit tiles must be hollow and two or three inches thick; but generally contractors have done as they chose to do, specifications only stating that the bottoms were to be covered with tile. The thick soffit tile, it will be observed, made it necessary where flat arches were used, to lower the ceilings to an amount equal to the additional thickness of the soffit tile, and this meant a corresponding addition to the thickness of all the floors and a necessary addition to the cost of the building.

One of the few improvements in the manufacture of burned clay fireproofing during the last twenty-five years, was the discovery, said to have been purely accidental, that terra cotta when made semi-porous possessed great toughness and was not as likely to crack in a severe fire as hard hollow tile. Attention was called to this after the conflagration in 1894 at Pittsburg, in which two nearby buildings belonging to the Horne Estate were subjected to very severe fire tests. In the department store hard burned hollow tile was used. It had walls of from one-half to five-eighths of an inch in thickness, and was badly cracked on the exposed side. In the office building a hollow tile was used called "Terra Cotta Lumber" with walls about one inch thick, and solid tile around the columns about two inches thick. It was made of a dark red vitrifying clay, and with only about one-half of the usual quantity of sawdust

that had been employed in the manufacture of porous terra cotta, for producing the porosity when burned out in the kilns. The discovery was a valuable one, for only occasionally was a hollow tile in the Horne Office Building found to be cracked, and the solid tiles had been found to have entirely protected the iron columns. Since the publication of this discovery some manufacturers have made all their hollow tile semi-porous to avoid, if possible, the objection to the fact that the exposed bottoms of hollow tile have cracked off in numerous instances of fires in buildings in which they have been used.

The diminished use of porous terra cotta for protecting the constructional steel members, is one of the evidences of the decadence in the art of fireproofing with burned clay since about 1890. Up to the present time porous terra cotta partition blocks have continued to be used in some buildings in New York and the Eastern cities. One factory at Pittsburg continues to make it, and the whole product of one factory at Chicago for fireproofing purposes is porous terra cotta.

RESULTS SHOWN BY CONFLAGRATIONS

The conflagrations at Baltimore and San Francisco have demonstrated the defects in hard burned hollow tile as a fireproofing material for all purposes in one respect. While the floor arches have preserved their stability and have demonstrated their value as fire stops, and column and girder coverings have in most cases preserved the steel construction from collapse, in nearly all instances of exposure to severe fire the hollow tile has had its commercial value as a permanent building material destroyed by the breaking away of exterior shells from an unequal expansion in each material unit. This defect has been most pronounced where it has been used for column and girder protection. In the latter cases the destruction of the tile has been due not only to the breaking off of the exterior shells, but to the longitudinal expansion of the entire column covering. When the bottom and top of such covering is built in firmly between the top of one girder and the bottom of the next girder above, the longitudinal expansion of the whole covering naturally causes it to be crushed between the unyielding end-bearings. This was traced, showing different amounts of expansion and corresponding destruction by crushing, in a tier of columns in the Horne Department Store at Pittsburg after the second fire in 1897. As opposed to this experience severe fires that have occurred within the last ten years in the two buildings of Martin Ryerson at Chicago, one on Wabash Avenue and Adams Street and the other on Randolph Street near State Street, each of these stores was subjected to a very severe interior fire. In both the columns were protected by solid blocks of porous terra cotta, screwed to the iron, and in neither case were they injured in the least. Neither were the porous terra cotta girder coverings in these two buildings in any way injured by the fire. The ceilings of the former building were of porous terra cotta tile screwed to the wooden floor joists and the fire was confined to the story in which it started.

Hollow tile partitions have failed badly both in Baltimore and San Francisco conflagrations. Where the severe fire occurred on one side they cracked and their hollow spaces were exposed, and they were often thrown down by excessive warping. In more instances their fall without apparent cause, since the several blocks were found unbroken, can only be attributed to vertical expansion of the whole partition when the great heat was on both sides, causing them to bulge and fall, because there was no relief for the expansion between the floor and ceiling. The problem how to prevent this is worthy of very serious consideration now. It has long been insisted that the partitions should be built on the floor fireproofing and wedged tightly to the ceiling. But it looks as if this supposed carefulness might have been the very cause of their collapse.

These few illustrations may serve to give some indications of the present condition of the fireproofing art with burned clay. Many others might be added; and it will naturally be asked, why should there be retrogression in the art, and why should these errors still continue to be repeated. The answer involves a serious consideration of the duties of present day architects and their relations to the contractors, as much as to their clients. It involves a consideration of the educational qualifications in which one is compelled to admit that the present day architects are quite as deficient as their progenitors of thirty years ago. The engineering press has, during the last few years, given much space to discussing the merits of this or that used in fireproofing buildings. The architectural press has given but scant attention to it, confining itself mainly of quotations from the engineering journals. The latter have taken it upon themselves to regard fireproofing as an engineering problem. It is difficult to see why it is not much more a problem in chemistry and mechanics, if it is not

entirely an architectural question. It is a matter only handled by architects in practical life, and should not be left to the engineers, who have little practical use for it.

FAULTY FIREPROOFING AND THE NECESSITY FOR A STANDARD SPECIFICATION

One can point to a few reasons for this state of affairs. The first and most elementary is that no attention has been given to fireproofing in the courses of study presented in the architectural departments of the several universities which assume to provide education for architects. It has been attempted recently in a few of them to give courses on reinforced concrete. All well and good, since that has recently entered largely into building construction. But why not make concrete construction and fireproofing merely a division of a broad curriculum in which the theory and practice of fire prevention is the basis of all such instruction? Why not treat all systems which are supposed to be fireproof from the separate points of view of fireproofing and construction? They are by their nature correlated subjects. Considered separately the clay systems and the reinforced concrete systems are the two principal ones employed in modern practice. Each has its advantages and its defects structurally, as well as advantages and defects from the fireproofers point of view. These should be understood and defined in any acceptable curriculum.

Another reason for the condition of the art to which attention has been called, is that there are no reliable experts in fireproof construction. If there are, there are none practicing it professionally, and, as far as is known, there are no architects or investors in building operations seeking for such experts. There are those who assume to be experts in reinforced concrete, but they are generally representatives of systems which are competing against each other. If there are any experts in the burned clay systems they must be in the employ of large companies engaged in the business. On all sides such experts as there may be must be mainly interested as contract getters. Another kind of experts are those employed by the great fire underwriting organizations. As things look at present they are the only real and reliable experts. But they are not there to assist architects, though glad to be consulted. The great underwriters' laboratory at Chicago is piling up information of inestimable value, applying the crucial tests that reveal the weak points of materials and combinations of materials, which are employed in buildings, day by day, with indifference to their real qualities and powers of endurance. In course of time this information will be available, but only after more mistakes are made and more conflagrations reveal the blunders which could readily be corrected.

If it were revealed how the specifications of most architects had been made defining the materials and method to be employed in the fireproofing of hundreds of buildings that have been erected in the last twenty years, it would make amusing, as well as instructive reading matter. Those only who are experienced in the art and have the opportunities afforded to competing contractors, could tell the tale. Too often the contracts are carried out in accordance with the stock phrases "equal to" or "as good as" which are supposed to be for the protection of the owner. The low bidder gets the job and the owner gets the gold brick.

The specification writer must do his duty to his employer and cover everything that goes onto the building whether he is versed in the matter in question or not. In rare cases the architect consults some contractor whom he deems to be an expert. The contractor conscientiously leads him up to the making of a good specification. But the inexpert contractor estimates according to his own makeshift methods, and, the bids having been opened, his low bid takes the job. The owner is satisfied if the work complies with the building laws, and overrules the architect, if he should say a word in behalf of the better method. The next time the expert contractor is less conscientious.

Perhaps neither the owner nor his architect realizes that there are many kinds of burned clay and many kinds of concrete, that there are materials and methods of assembling and securing them that have failed in recent conflagrations, and others that have valiantly served their purpose. They are fully satisfied until they run against the expert whom the underwriters now send to examine the work. But then it is too late to make changes and the owner has to stand the loss in premiums which the underwriters relentlessly exact.

ELEMENTS OF THE ART OF FIREPROOFING

The whole art of fireproofing successfully consists of two things; first, the materials to be used and, second, the methods of placing them where they will stay until they have fulfilled their purpose. We have heard of materials that fail in themselves, and methods of setting both good and bad materials

which result in their downfall when exposed to severe tests. The method of assembling them is the most important. It can only be corrected by one who has been observant of all the failures. Still it may not be corrected even by this expert. He may in so doing fall into another unforeseen difficulty. More observation and experience is necessary. The shop test is not always reliable. The contingencies in a large building subjected to a severe fire differ in all cases. The coolest judgment is necessary to control them.

The common failing with all who are called upon to devise fireproofing systems is the want of a full realization of the varying intensity of heat in a burning building, the consequently irregular expansion of the fireproof material by heat and the effects of drafts engendered by the very nature of the plan and arrangement.

As a general theorem it must be assumed in all cases that the fireproofing should be sufficient to save itself and save all that is behind it. In so doing it saves the general construction. All inside finish and machinery is destructible. The value of this in any first class building approaches fifty per cent. of the cost of the whole.

The conditions are the same whether burned clay methods or concrete methods are used. All hollow burned clay tiles crack by unequal expansion. A method must be found, if not to prevent this, to cover them in such a way that the covering material only will be damaged. Solid porous tile is often found to be the remedy. Concrete, according to the most reliable experts, is subject to surface disintegration according to the intensity of the heat, and its duration. If this cannot be prevented the concrete must be protected by something which will receive the damage and can be renewed if necessary without much expense. Experience has shown that a hard burned fire clay tile cracks only once in its lifetime. Unequal expansion is its only weakness. Its hardness is not affected by re-heating. It can only be fabricated and burned in the hollow form. But it can be split into flat tile or flat tile with projecting webs after burning. This is a common practice where slabs are needed for any purpose. Thereafter they will not crack with intense heat, and their expansion is possible without damage. Experiment in actual fires, as well as experience, have demonstrated that when secured so that they cannot be thrown off they are the best practical protection to the exposed surfaces of all burned clay materials, as well as to exposed concrete.

IMPROVEMENT NECESSARY

There is a necessity to-day for improvements in the art of fireproofing, which has not yet reached such perfection that it can be regarded as a standard system. Every great fire disaster brings the critics to their feet with denunciations of the futility of present day methods; but without the suggestion of intelligent remedies. All the systems are on trial to-day, but it is not therefore to be assumed that all are defective. Still the confidence of the public and of those who are immediately interested is too often shaken by the revelations of such examples as the destruction of the Parker Building in New York, one of the worst examples that could be found. The possible improvements in the art which have been pointed out, some of which are by no means new, but which failed of general recognition, will eventually be made as a result of recent agitation. Demands are being made on all sides for "standardization" of everything. Something of the kind should be done for this art if possible. There should be co-operation between architects to arrive at the best results. But more than all there should be co-operation between the architects and contractors. Without the experience of the latter and the results of their extensive investigations and tests any investigation of the real merits of materials and methods of construction would be fruitless of valuable results. Another invaluable addition to knowledge of the subject coula be found in the exhaustive tests conducted at the Laboratory of the National Board of Fire Underwriters.

The time has arrived for the formation of a commission to investigate the whole subject of fireproofing buildings with a view to arriving, if possible, at a standard specification. Such a commission could only be formed of repesentatives from the national body of architects, who should take the lead, inviting contractors of experience in the art, in both clay and concrete methods, and a representative from the Underwriters' Laboratory.